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DRAGON USER

August 1983

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How to submit articles

The quality of the material we can publish in *Dragon User* each month will, to a very great extent, depend on the quality of the discoveries that you can make with your Dragon. The Dragon 32 computer was launched on to the market with a powerful version of Basic, but with very poor documentation.

Every one of us who uses a Dragon will be able to discover new tricks and quirks almost every day. To help other Dragon users keep up with the speed of the development each of us must assume that we made the discovery first — that means writing it down and passing it on to others.

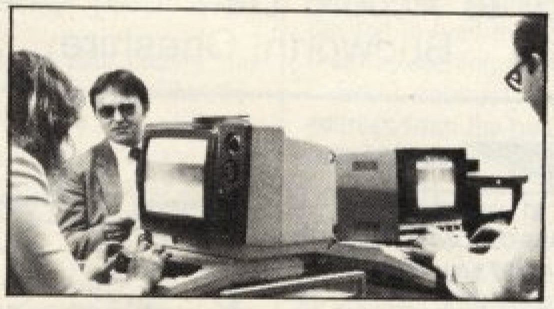
Articles which are submitted to *Dragon User* for publication should not be more than 3000 words long. All submissions should by typed. Please leave wide margins and a double space between each line. Programs should, whenever possible, be computer printed on plain white paper and be accompanied by a tape of the program.

We cannot guarantee to return every submitted article or program, so please keep a copy. If you want to have your program returned you must include a stamped, addressed envelope.

We pay for articles according to the length and the quality — it is worth making that extra bit of effort.

Contents

SUNSHINE



Editorial

LAST MONTH IT WAS confirmed that Dragon Data had set up a joint venture with Tano Corporation of New Orleans to cover Dragon sales in the US and South America (not forgetting the Caribbean Basin, of course). At the time the American end of the venture offered an interesting variant on the theme of "We're going to be rich, we're going to be rich." Its version was, admittedly, more restrained: "We are extremely excited about the market potential in our territories for the Dragon."

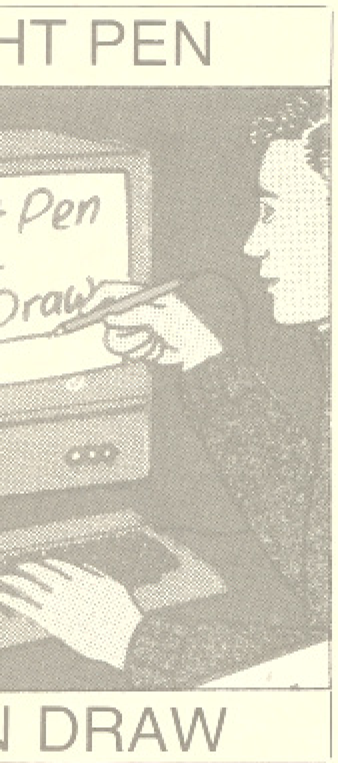
Interestingly, too, it added: "We feel we have an excellent opportunity to compete price wise in the US market." In fact, wise pricing, or its opposite, is the name of the game in America at the moment. Not-so-wise pricing appears to be Texas Instruments' policy. Earlier in the summer its share price fell after predictions of losses, mainly in the home computer business division — where it had dropped prices of the TI99/4A by $50. But Commodore's price cuts yielded improved financial results. The company is selling its 64 for only $199 in the US — and offering a further $100 rebate in exchange for a used Vic20.

So, what price the Dragon 64? In this country, Dragon Data appears to be caught between the proverbial rock and a hard place. Charging more than Commodore might be expected to damage sales. But competing with Commodore on prices might annoy 32 users considering an upgrade to 64K if this looks expensive compared to the Dragon 64. Pricing in the US is equally problematic. Presumably Texas Instruments and Commodore did the same sums based on similar figures, but they came up with different answers in their balance sheets.

Dragon Data and Tano appear confident that they have got the answer right. At the moment too many factors have to be taken into account to decide how well-founded their confidence is. If a dealer's magin is higher on a Dragon than on a Commodore machine it's not hard to work out which micro he will promote. And higher prices can be an asset. In a marketing test, a shop once sold the same shoes at two prices, without revealing the similarity to customers. The higher priced range sold better — perhaps Dragon Data and Tano have been reading up the results of this particular piece of research.

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A challenging and well-written game — *Dragon User*
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Lighter work

J BURFORD (Open File, June 1983) is making hard work of his machine code loading. His program could have been written far more simply as:

```
10 FOR A = 1540 TO 1549:
   READ B$
20 POKE A, VAL ("&H" + B$)
30 NEXT
40 DATA FF, EE, DD, 01, BE, 67,
   0B, C0, 9A, 3B
```

The same technique could also be used to enter Ian Nicholson's (same issue) Machine Clock. Why take the trouble to enter &H before each number, when the Dragon will do it for you?

K A Blackwell,
Southampton.

A little knowledge

WITH REFERENCE to your answer to the query in June's edition regarding disabling the BREAK key, I think your answer illustrates the old adage that a little knowledge can be a dangerous thing.

The routine given uses the fact that the run time routine in the ROM does a call to 019AH (410) which simply contains a RTS (return from subroutine) instruction so that nothing is actually done. Your routine increases the return address by four thus bypassing the call to the "check for BREAK key" routine, thus disabling the BREAK key.

The first problem with your routine is that you do not appear to have taken into account the fact that the area of memory used by the routine already has a use and your routine will under certain circumstances cause a system crash.

The memory between 015EH (350) and 01ABH (424) is used as intercept vectors of three bytes each. Your routine not only uses the intercept locations for the run time routine but also the intercept for the LET routine 019DH — 019FH (413-415). Even if LET is not used in a program its routine is called by other routines.

When this happens a call will be made to 019DH (413) which will result in the return address on the stack being overwritten by whatever value happens to be in the D register and the system will, on reaching a RTS instruction, jump to almost anywhere. Also the routine relies on the fact that the intercept of 01A0H (416) is unchanged and still contains a RTS instruction.

The routine itself appears correct but it does ignore certain facts. First, it not only bypasses the call to the BREAK key routine it also bypasses an instruction to clean up the CC register. Secondly, the BREAK key routine does more than check for the BREAK key it also checks for SHIFT@ used to pause a Basic program.

The intercept vectors should be changed only to a jump instruction, unless you are writing a two byte routine, thus if your routine was to be stored at 7000H then:

```
POKE 410,&H7E jump instruction
POKE 411,&H70 address 1st byte
POKE 412,&H00 address 2nd byte
```

will cause the call to 019A to jump to your routine at 7000H. The routine must exit via a RTS instruction.

In addition to your coding you should add the missing instruction to clean up the flags and also add a routine to replace the SHIFT@ routine. I would advise against using any of the first 1K of memory as this is used for system variables, unless the exact nature of the usage of that location is known.

J W Bailey,
Sunderland.

Wrapping around

IN THE article on Topsy, in the June issue of *Dragon User*, Pam D'Arcy stated that it was impossible to use a negative offset with the CLOADM statement. Although this is true the same effect can be obtained by using a technique that is known as wrap-around.

Wrap-around occurs in a 16-bit counter when on reaching its maximum count the next increment causes the counter to return to zero. The offset used with the CLOADM statement has this same property of causing wrap-around when the new calculated start address exceeds the maximum 16-bit count ie 65535 decimal.

In order to calculate the offset required with the CLOADM statement, first subtract the value of the original start address of the program (ie the start address from which the program was originally saved) from the value of the required new start address. If the result of this calculation is negative then add to it the value 65536 decimal in order to produce a positive offset value.

An example using hexadecimal numbers best illustrates this technique. Assume that the original start address of a program you wish to load was 7000H (note the H suffix indicates a hexadecimal value) and assume that it is desired to load this program into memory starting at 5000H.

First, subtract the old start address from the new:

```
  5000H
 -7000H
 ------
 -2000H
```

Since the result of this calculation is negative now add to it the value 10000H (ie 65536 decimal):

```
 -2000H
+10000H
-------
  E000H
```

Hence the required offset value would be E000H or 57344 decimal.

Proof:

```
  7000H — Original Start Address
+ E000H — CLOADM Offset
 15000H — New Start Address
```

Note that the carry generated from this sum is lost as the result exceeds a 16-bit binary quantity, ie wrap-around has occurred. Hence the new start address is 5000H.

Martin Dunn,
London.

Questions answered

RODNEY BENNETT'S line 'LIST X to X + 10' in your June issue causes a syntax error because the LIST command only accepts constants, not variables or expressions, as parameters. These constants must be decimal line numbers.

In answer to Frank Hart, LLIST (which is dealt with on page 132 of my copy of the manual) is the printer equivalent of LIST. DLOAD, I guess, is a call to some other disk operating routine, not covered in the manual because disks hadn't been invented when it was written.

All reserved words are stored in ASCII format in the ROM, but the final character has its most significant bit set to '1', whereas all ASCII character codes have '0' in this position. This is commonly used to indicate to the search program that the current word has ended. Try altering line 20 of the program to read:

```
20 A$ = CHR$(127 AND
   PEEK(I))
```

This will clear the indicator bit, display the whole words, and answer the query about TAB — the hidden symbol is a left parenthesis, which always accompanies TAB, and so is regarded as an integral part of the word.

And if Chris Denne is reading this: you don't need a FOR loop to add up successive integers. Try this:

```
10 INPUT "NUMBER"; N
20 PRINT N*(N+1)/2
30 GOTO 10
```

John M Kerr,
Glasgow.

No go for renumber

ROBERT SHELDON'S routine (June) for placing a copyright in line 65535 does not, unfortunately, protect the line from deletion.

Using RENUM, line 65535 can be decreased below 64000 and may then be deleted or edited as required.

Norman Silver,
Chislehurst,
Kent.

Software Top 10

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2	(—)	**Talking Android Attack**	Microdeal
3	(—)	**Nightflight**	Salamander
4	(—)	**Dragon Trek**	Wintersoft
5	(2)	**Space War**	Microdeal
6	(—)	**Graphics System**	Salamander
7	(5)	**Katerpillar Attack**	Microdeal
8	(8)	**Chess**	Dragon Data
9	(—)	**Mined Out**	Quicksilva
10	(9)	**Typing Tutor**	Dragon Data

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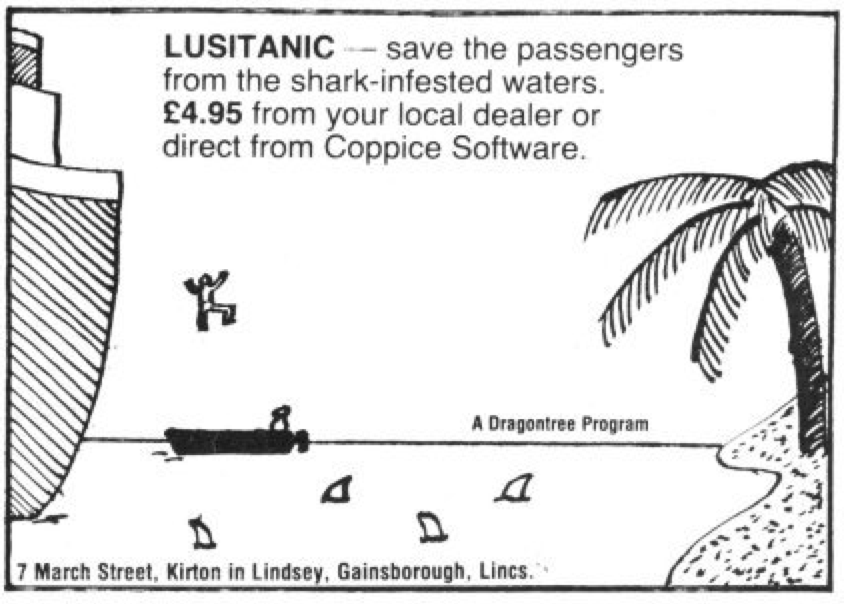
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PNP lines up more add-ons

AN RS232 interface and a PROM programmer are next in line from PNP Communications, which is already offering a relay board and analog to digital converter for the Dragon.

Both plug into the Dragon's cartridge port and are expected to be available in mid-August. The interface will cost under £25 and the programmer under £50.

A board with two relays costs £16.80, rising in multiples of two to eight relays for £35.85.

PNP is on (0273) 514465.

Statacom cuts cost of word processing

SUTTON-BASED Statacom is cutting the cost of word processing as part of its drive to promote business uses for the Dragon.

The company is offering discounts on word processing packages consisting of Microdeal's Telewriter plus various printers.

The more advanced the printer, the higher the reduction — rising to nearly £100 off the most expensive combinations.

Statacom also sells the Luxor composite video monitor/tv which improves the Dragon's picture for business use.

As Steve Vennell of Portatel, the Luxor's distributor, says: "Using this monitor means there's no patterning and you get a cleaner, brighter picture."

These advantages also apply to games players, a market which Statacom is equally keen to capture.

Users are encouraged to call in at the shop to try out games, and different cassettes are available at discounts each month.

Statacom can be reached on 01-661 2266.

US to see 64 before the UK

THE US is to see the Dragon 64 before the UK, but the OS9 disk drive system is likely to be available here first.

The Dragon 64, at £225 including VAT, will be on sale in the UK from the end of August/beginning of September. But in the US, where the machine will sell for $399, shipments will start from the beginning of August.

Richard Wadman, Dragon Data's marketing director, explained the difference in timing: "The US tv circuitry is easier to construct than the UK's, so we can do it more quickly."

The OS9 drives will not be affected by this so "these will probably be available in the UK first".

As OS9 leaves little user memory available to 32 users once it is loaded, these drives will not be on sale until "just after the UK launch of the 64".

At about the same time a CPU swap should be on offer at under £100 upgrading Dragon 32s to the 64.

In addition to the extra 32K of memory, the main difference between the 32 and the 64 is an RS232 interface — included as part of the upgrade.

Richard Wadman added that "there will be complete software compatibility between the Dragon 32 and the 64".

Apart from tv circuitry, there will be no differences between the European and American 64s. However, the Dragon 64 will be marketed as the Dragon in the US.

Dragon sales in the US will be handled by a newly formed company, Dragon-Tano, a joint venture between Dragon Data and New Orleans-based Tano.

Over 55,000 American Dragons are expected to be sold before Christmas. Tano intends "to have the product in place for the back-to-school and Christmas buying seasons".

Software out in strength at Fair

THE increasing range of Dragon software was on show at the Earls Court Computer Fair — but there was little new activity on the peripherals front.

First stop for most Dragon users at the show was a cluster of three stands: Microdeal's, Salamander's and Dragon Data's.

Salamander introduced Everest, a simulation of a modern six-man expedition, and Gridrunner, its first conversion of a Jeff Minter arcade game for the Vic20. But Pete Neale said that demand was highest for Franklin's Tomb, the first in a series of adventure games (reviewed in this issue).

Down the aisle (and often a lot further afield), Microdeal's wandering robot succeeded in luring customers to the company's stand.



Show-stealer – Microdeal's Android in friendly attack

At the stand across from Microdeal, Dragon Data was showing its range of software, including Shark Treasure which features fish with a particularly sharp and snappy set of jaws.

It was also showing, but not selling, its disk drive system — to the obvious delight of Premier Microsystems which reported disk demand for its own drives.

Distributed elsewhere in the hall were other software exhibitors. Bamby Software, MC Lothlorien, Quicksilva and Shards Software, launching its Empire strategic game, made up a strong Dragon contingent.

More than 10 users' groups had stalls at the show, including the 68 Micro Group.

This club aims to provide a focus for any micro owner who wants to know more about the workings of his machine, especially those machines belonging to the 68 family of microprocessors — which includes the 6809-based Dragon.

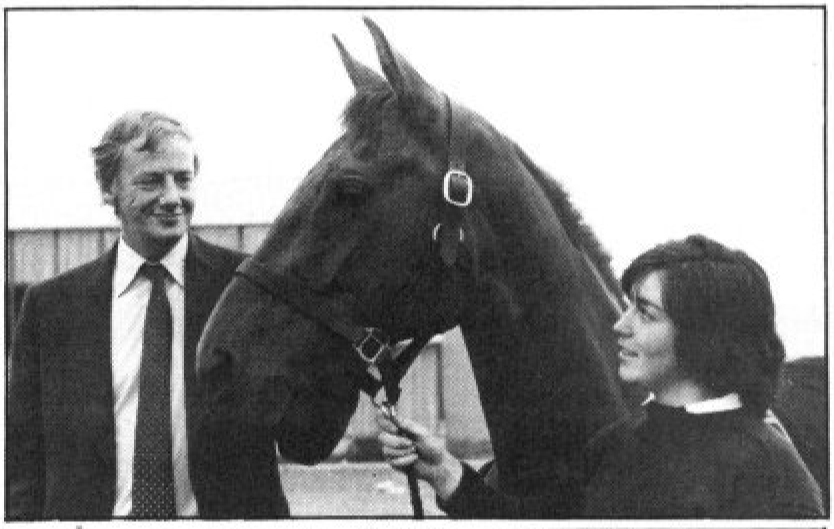
The club can be contacted by writing to 41 Pebworth Road, Harrow, Middlesex.

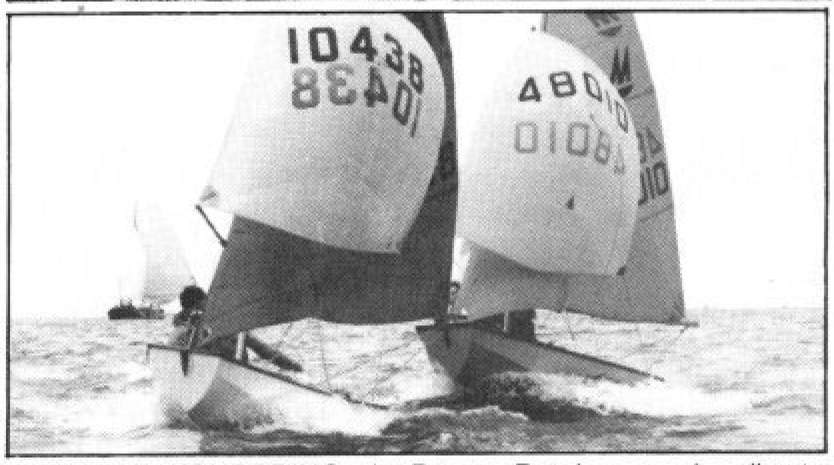
Also of interest to Dragon owners was a new service demonstrated by Maplin at the show. Called Cashtel, it allows users to place orders for software and electronics products directly into Maplin's computer via their own machines.

Maplin says it can supply modems to convert Dragon data into a form that can be transmitted over the phone line.

News Desk

01-839 2449





IF YOU'RE WONDERING why Dragon Data's managing director Tony Clarke is exchanging eye-to-eye glances with a horse, and why a yachting photograph is appearing here, the answer is simple: Dragon Data is sponsoring both. Rosalind Bevan, a member of the British junior eventing team, and her horse Horton Venture are being backed to the tune of £10,000 a year over three years. The other beneficiary is this summer's world championship for Mirror dinghies. There's a Welsh connection: Rosalind comes from Swansea, where the dinghy races will also be held – at the Mumbles Yacht Club.

Sprites lined up for the Dragon

PREMIER MICROSYSTEMS, the first company to produce Dragon disk drive systems, is developing three new boards for the Dragon: a graphics system giving sprites, a sound card and a motherboard.

Premier aims to have the first two ready for the PCW show in September; all three slot into the Dragon's cartridge port.

The graphics system, expected to cost less than £100, is based on a Texas Instruments specialist chip. It gives the Dragon a high resolution 192 by 256 display in 16 colours.

Sprites — movable graphics shapes — can be defined using Basic commands which take the form of an extension to the Dragon's Microsoft Colour Extended Basic.

The sound card, based on a General Instruments sound chip, will cost less — £60-£70.

Providing six channels of music plus an input/output port, it can be used with a hi-fi system, playing any selection of channels through either speaker.

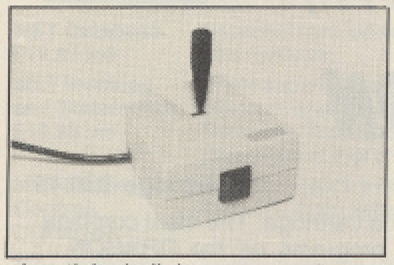
Premier is also working on a motherboard to allow Dragon owners to use all these devices at once (the company's drives also slot into the cartridge port). This will be a six-slot unit, available by the end of the year.

Premier can be reached on 01-778 1706.

News Desk

01-839 2449

Midasonic joysticks arrive



Joysticks in light green casing.

THE LATEST joysticks to arrive for the Dragon come from Surrey-based Midasonic.

Retailing at £17.50 per pair including VAT and postage, the joysticks come in a light green casing. Shaun Tredinnick commented that they have "a light, very sensitive action".

Initially the sticks are only available by mail order, but the company is looking into retail sales at the moment.

Midasonic is on (0252) 875200.

Mumps set the pace for high level languages

THE ARRIVAL of the Dragon 64, and the upgrade from 32K, will bring a host of new languages in its wake — including Mumps, a high level structured language which is upwards compatible with minicomputers and mainframes.

As its name suggests, Mumps was originally developed for medical applications. But its ability to cope with the problems of large information systems has encouraged its use elsewhere.

It is a block structured language, similar to Logo in structure and modularity, with some commands resembling Basic.

Thoth Data will be selling the Dragon implementation in the UK for under £100 including disk and manual. Nigel Pitkeathly commented that this was cheap compared to £800 for DEC minis.

The package will be available at the same time as the Dragon 64. It needs 50K of memory so 32 users will have to upgrade.

Thoth Data will handle sales of Mumps to the medical market. It is negotiating with a large company to handle mass market sales.

The Dragon implementation conforms to an agreed standard. This means that any program written in Mumps on the Dragon can be run on a DEC mini or another manufacturer's mainframes which conform to the same standard.

Nigel Pitkeathly expects "anybody who wants to store large amounts of information" to be interested in Mumps.

The Dragon implementation is among the first for a home computer. Nigel explained: "It's hard to do on any 8-bit machine which is not 6809-based."

A recent health service report classifies Mumps as an ultra high level programming language. As Nigel puts it: "This simply means that less code does more."

He added: "A typical accounts receivable program written in Cobol was converted to Mumps. The number of lines of Mumps code required was 8 percent of the number of lines of Cobol."

DEC uses Mumps for its own internal mail network. This links 1,500 users in four sites in Europe and America handling four million messages a year, of which one million are online at any one time.

Thoth Data can be reached on (0533) 559711.

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Holiday haven spreads its net

Wareham is the home of the Dragon 32 Users' Club, a haven for holiday-makers and postal members alike.

FROM MAGAZINES to micros is the direction in which John Richardson's career has travelled. But the micro has brought him full circle — he now puts out a monthly newsletter about the Dragon 32.

The newsletter is one of the benefits you're entitled to as a member of the Dragon 32 Users' Club. John runs the club from Games and Computers, his shop in Wareham in Dorset. The shop was only opened last year — and the club only two months ago — but already there are more than 1,200 members.

First moves

John spent most of his life in publishing before moving into microcomputer retailing last year, after the ZX80 had sparked off his interest. He started by selling fantasy games with the computers as a sideline. But now he is totally involved with micros, selling the Dragon 32 along with Grundy's' Newbrain and the Oric.

He was so impressed by "the intense enthusiasm of Dragon owners" that he felt a club was needed. He explained that Dragon owners showed the same friendly spirit "as MG owners when they dip their lights on meeting other MG drivers".

One of the advantages of having the shop means that club members can come in and try out Dragon add-ons and software. Already members holidaying on the south coast are stopping off at the shop. John stressed that he was as keen that mail-order members should receive an equally efficient service.

Orders for goods in stock are dealt with immediately, and John thinks that his relationship with suppliers is good enough to get out-of-stock items in quickly. Last Christmas he managed to meet orders for Dragons — even though it sometimes meant going over to Wales to pick up the machines. John commented: "Dragon Data helped us enormously."

One of the aims of the club is "to give members as much information as possible which is complementary to the books and magazines already available." Hence the newsletter which he hopes will have 12 pages in its next issue. This contains details of a star program offer, hardware and software reviews, a "pen pals column" for Dragon owners, and advice for users.

Members also receive copies of Games and Computers' catalogue, which is going up in size from 16 to 32 pages. The shop stocks software from most suppliers, including Salamander, Microdeal and J Morrison. The most popular games are Champions, Drone, The King, Pimania, Ring of Darkness and Microdeal's recent release, Talking Android Attack.

But a lot of members are keen on doing more with their Dragon than playing games. Demand for Compusense's utility packages is strong, and for the book *Programming the 6809*. John commented: "I'm surprised so many of our members are interested in machine coding."

Hardware for sale includes Cotswolds Computers' RS232 interface, Premier Microsystems' disk drives ("a superb system") and a range of printers. John is particularly impressed by the Shinwa CP80, and by the Tandy four-colour printer which "is lovely to use". At the moment he is trying to negotiate a deal to sell members the Tandy printer at a cheaper rate. As John explains: "I'm always looking for things to do through the club at a good price." Members already receive discounts on most hardware and software they order.

Members also receive a free 'Toolkit' cassette when they join. This begins with an opening routine introducing the club — more routines and utilities will follow later.

Growing team

The first 1,000 people who joined the club did so for nothing. Now it costs £5 a year to join in the UK (or £3 for a six-month trial) and £8 overseas. John said: "To operate the club successfully and cover our effort and postage, we need to charge now." With so many members the club's administration now involves other people: Mary Crichton, Colin Lennox-Gordon and Lisa Speers share some of the load. In the evenings and at weekends Alan Monaghan, Keith Farmer and David Delaney also give their time to work on members' problems and new program ideas.

John is "pleasantly surprised" about the number of overseas members. There are some in every European country, including Iceland, and further afield in Oman, Australia and New Zealand.

He's also pleased that there are "quite a few members from educational establishments". In fact one school teacher enrolled 10 pupils in the club and a lecturer at Liverpool University is also a member. John is particularly keen on the Dragon's educational applications and the new catalogue contains six pages of educational material.

This interest is reflected in a new project planned to start in September. Combining his interest in micros and publishing, John will then be launching a cassette-based magazine, *Dragon Wings*, containing teaching routines as well as ready-to-run programs. For more details on the club write to 31 North Street, Wareham, Dorset.



From the left: Lisa Speers, John Richardson, Colin Lennox-Gordon and Mary Crichton

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MAY LUCK TRAVEL WITH ALL WHO TREAD THIS PATH.'

And this review be your guide

***John Scriven** hits the adventure trail – with some stops along the way for arcade games*

I FIRST ENCOUNTERED an adventure game back in 1978. It was about six o'clock and after a busy day entering data into a mainframe, I was about to clear up and leave. More as an afterthought I checked through the library of files to see if there was anything more interesting than the usual rather feeble versions of Startrek or Lunar Lander. There, innocently enough, was the name: Adventure. Not knowing what to expect, I loaded the program and typed RUN.

"You are standing at the end of a road before a small brick building. Around you is a forest. A small stream flows out of the building and down a gully. What now?" I remember sliding into bed at about four the next morning after a hectic night exploring the Colossal Cave. I even managed to bring out some gold and silver. The next evening I found out what "PLUGH" meant, discovered the magic beanstalk and finally became hopelessly lost at Witt's End — I was hooked!

The game I had unwittingly stumbled upon became an essential evening activity, and soon, others were becoming ensnared in the underground world I had discovered. Coffee breaks were spent discussing how the bear might be persuaded to give up his gold chain, or whether it was possible to retrieve your treasure once the pirate had stolen it. Eyes turned red, faces became haggard and even some marriages were less than secure as people arrived home in the small hours after "working late"! The insidious adventure bug had bitten hard.

Coming down

The actual game had been brought back from the States and was a version of the original Crowther game written a few years previously. In subsequent months I discovered some of the Scott Adams' adventures, but again, these were not written for anything smaller than fairly large machines. I was pleased to renew my acquaintance with adventures a couple of years ago when micro versions began to appear.

The Dragon was short on adventures when it was released last year. Madness and the Minotaur and Quest were the only games available from Dragon Data, and it is only recently that a good selection has appeared on the market.

For those of you that are not too familiar with adventure games, here is a brief over-view of what you can expect. In Crowther's Colossal Cave adventure, you could explore a giant cave system by using compass directions and up, down, climb, etc. Various objects littered the caves, some useful and some not. Every now and then, you would discover a treasure which would usually require a bit of thought before it could be removed to the little brick building at the start. There were, of course, unpleasant creatures who had to be outwitted or destroyed before this was possible. The whole adventure used only text — descriptive passages to tell you where you were. This was partly due to the fact that teletype terminals were far more common than visual display units in the early seventies, and also because even in machine code, adventures use up a lot of memory.

Madness and the Minotaur follows in the path of the early adventures in being text only. In some ways this is not a bad thing — just as a well-written book is often better than the film, text adventures can summon up your own images of the places you visit. Quest is not really a pure adventure in the true sense, as it combines elements of trading games. You must acquire objects in cities that help you in your final siege of Moorlock's Citadel. The visual sections of Quest are limited to a useful map of the kingdom showing your position. More recently some maze games such as Phantom Slayer and Sultan's Maze have incorporated 3-D graphics to show you your position, but they could hardly be classified as adventure games.

The games I have been looking at this month show the influence of earlier adventures, although some are combining different approaches in an attempt to produce something new.

Tradition

Dragon Data has gone for the traditional text-only adventure with its selection. Black Sanctum is set in a cold wasteland. If you can reach the cabin, you will find messages, objects and a sleeping figure upstairs in bed. Exploring further, you find yourself in an eighteenth-century monastery full of mysterious hooded figures and an over-powering sense of evil. This is not a game to play late at night, unless you have a crucifix or even bell, book and candle to hand!

Calixto Island starts off in Professor Lagarto's comfortable study. Should you manage to find your way round the house collecting objects you will eventually discover a secret way down to the professor's laboratory. As you stand there clutching such unlikely objects as hiking boots, spectacles, a bucket and a pump, you may be lucky enough to discover a teleporting device. This is where the real adventure begins, although anything more I say will remove the fun (or is it just frustration?) from this game.

The next adventure from Dragon Data caught my eye when I saw it was written by Kenneth Kalish, who writes some pretty good games for Computerware in the States. El Diablero also seemed the most interesting of all the plots. You awake in the middle of a desert, dazed and confused. Apparently, an old man has been teaching you sorcery and his enemy, El Diablero, has begun to work his magic. Aha! I thought as I began this game. Having spent a portion of my youth reading Carlos Castaneda's books about Yaqui Indians and desert sorcery, I imagined I would have a head start.

Unfortunately, after a week of wandering round the desert and finding only a crow and a strange rock I gave up. Obviously my knowledge of Don Juan's secret power couldn't help me in this game. I shall have one more try before I send off for my extra clues from Dragon Data! Undoubtedly I am missing something glaringly obvious, and most of you will probably have no difficulty in getting started at all. It does, however, point out a constant problem with adventures, knowing where exactly to aim the game: too easy and there's no sense of achievement; too hard, and the player gives up in disgust.

The last game from Dragon's own software house in Wales is Dragon Mountain. While the previous programs are all in machine code, this is written in Basic. The response times are therefore longer, but that does not interfere with the game. In contrast to El Diablero, I managed to reach the treasure in just over an hour, and ►

◀ there was little point in playing the game again. Maybe I was lucky, but it did seem to lack much challenge.

The game starts outside a mountain where a sign reads: "You are entering Dragon Mountain. Great wealth can be yours if you can slay the guardian of the treasure." Each time you play the game the locations stay the same, but the position of objects and creatures seems to change. There are one or two small inconsistencies, such as entering "Get elf" when one is near produces the message "I don't see that here. An elf is in the room". This sort of reply is not uncommon in adventure games, as an enormous amount of memory would be needed to consider all possibilities. What would have been better (and cheaper on memory) would have been to reply: "You can't do that" to all but the correct response. Once you have discouraged or destroyed the three guardians, it is an anti-climax when you reach the treasure — you don't even have to fight your way back out with it. If you are new to adventures then you might find this game a good introduction, and it is priced reasonably at £4.95. If you want something to get your teeth into, the other Dragon Data offerings are better value, although more expensive at £7.95.

Microdeal must offer one of the largest ranges of Dragon software now available. I enjoy some of its games a great deal — Phantom Slayer, for instance — but I have not been so impressed by its adventures so far. Mansion Adventure involves exploring an old house; Williamsburg Adventure a colonial town; and Jerusalem Adventure, naturally enough, Old Jerusalem. Of the three, Jerusalem Adventure is more interesting, but still only of average difficulty. If you stray into the Arab quarter you get killed, which seems a bit unfair on the poor adventurer, and does nothing to improve Arab/Israeli relations. I don't wish to appear over-sensitive, but "a hooded figure from the casbah has just ended your life" is less provocative than "you are attacked by an Arab and he kills you".

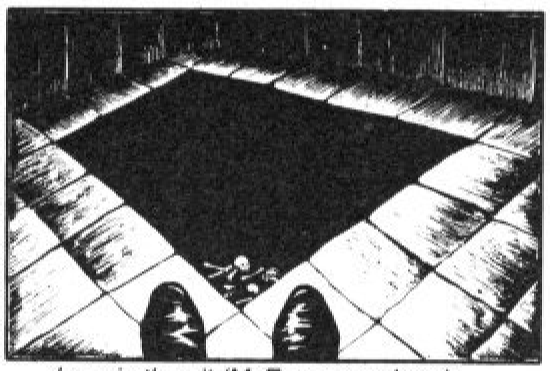
I wondered why these games seemed less impressive than the original Colossal Cave adventure and I think that the answer must lie in their relation to books. Colossal Cave contains beautiful descriptions of underground volcanoes and the colour of the rock crystal — even the smoke from disintegrating dwarfs is described in oily detail. If the game only says "you're in the front room. I can see a TV", then you lose a great deal. These games don't even make up for their thin plots by using a few graphics and are mainly pretty humourless. They are only on a par with Dragon Mountain in terms of excitement, and seem expensive at £8.00.

Diamond

Salamander Software has got round the problem of detailed graphics by issuing purchasers of Franklin's Tomb with a 20-page booklet, containing pictures of most of the locations. Arriving in the usual smart packaging, this game has been written with some care, even if the tongue is firmly in the cheek. "My name is Diamond. Dan Diamond. I'm a cop, at least



Franklin's Tomb: Salamander's stars and . . .



. . . down in the pit (McEnroe was here)

I used to be. That was then, this is now, and nobody knows what tomorrow will be . . ." The start reads like a cross between Raymond Chandler and Dashiel Hammett, and the game itself, played in the crypt of an eerie graveyard, goes from Private Eye through Hammer Horror to Space Fantasy.

If it sounds confusing, it is, but that doesn't mean that the game isn't fun to play. The screen is split up into three sections: location description, personal inventory of things you've picked up, and a list of available exits (start worrying when this is blank!). There is a save file facility to save your present position on cassette, which is useful just before you launch yourself into the unknown. As this contains merely your present position and inventory, it only takes 20 seconds or so to save.

As in all adventure games, you need to draw a map to know where you are when you need to retrace your footsteps. Seeing that most objects seem to be useful on the other side of the building you soon know your way from the bathroom to the acquarium. The object of the game isn't stated directly, although as you play it, you realise that some objects are only useful if dumped at a strange location at the end of the crypt, where you leave this game and start the next cassette in the series. A crafty marketing ploy it may be, but this game is certainly fun, and I shall look out for the sequel with interest.

The last adventure I have looked at is from Wintersoft. At £10, Ring of Darkness is more expensive than Dragon Data's and Microdeal's, so the question must be, is it worth the extra amount? On loading, an introductory program allows you to choose the character for your adventure. You can choose his or her name, distribute points for intelligence and strength, and select whether you require him to be a human, elf or dwarf, and whether he should be a wizard, a thief or a warrior. Other points are awarded according to the character chosen, then the main program is loaded from the cassette. After this Dungeons and Dragons start, the first part of the game resembles Quest. A map of the terrain appears, showing your position, as well as places of interest, such as towns and lakes. As you make your way using the cursor control keys, you are waylaid by assorted rogues, vagabonds, sorcerers and hidden archers.

At the beginning you have little in the way of weapons, experience and gold, but if your character choice was reasonable, you can win a few fights and reach a town with bulging pockets. Should you lose and be killed, you are resurrected with an increase in experience points — an interesting philosophical point that should appeal to Buddhists! On reaching the town, a machine code routine is employed to produce a high-resolution plan of the particular place that you are visiting. You need to keep your stocks of food fairly high, and you can buy weapons and transport (yes, even a hovercraft!).

When you are well equipped you can enter one of the underground mazes to continue your quest for wealth and fame. This necessitates loading in another program that displays the maze in hi-res 3-D, even allowing you to see the repulsive creatures that attack you. Should you wish to climb the ladder to the surface once more, you simply reload the original program, and your position and present state are merged into the new program.

I have to admit that this is one of my favourite games from this month's selection and shows signs of careful thought in its preparation. Seeing that it combines a traditional adventure with a 3-D maze game, a trading game and a D & D-type character choice, it would seem to be worth the price.

In the above games I have attempted to give a flavour of the particular adventure mentioned. The problem is that too much description will take away the fun of exploring for yourself. It's always more fun to make your own mistakes and then achieve success than to have someone tell you how to solve the mysteries. You may also find, as with all reviews, that you disagree with my choices. Ultimately, the best thing, as with all games, is to try them yourself and decide if you think they are the sort of program you want.

In the arcade

Now, for those arcade freaks who thought they'd been neglected this month, some new action material for your Dragon. Drone from Cable Software seemed very familiar as I read the detailed instructions. You are in command of a DRAG, a datatank inside a computer, and the object is to destroy the evil ROM guardian who is corrupting the system with bugs. You meet drones, bits and bytes, and the so-called talking robot trainer is called TROFF. Does this not sound rather similar to a certain Disney film? No? Oh, well, back to the game. The instructions are complicated, but so as to make your task slightly easier, a keyboard template is supplied (14 ▶

◄ keys are used in the game), and there is this "talking robot". If you expected a synthesised voice from your Dragon you may be in for a disappointment. The reverse of the tape contains a recording of someone who sounds vaguely like David Warner speaking through an echo chamber.

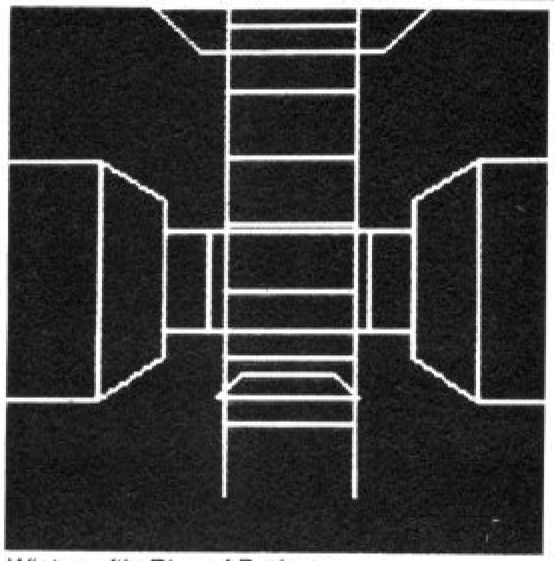
The display shows the view through the front of the tank together with a laser sight, proximity indicators and various other devices. As you approach the ROM guardian, you can use logic cannons to blast your way through memory tunnels to the guardian's tower. I have to admit that I found the number of controls and displays tiresome, but others who have played the game enjoy it. If you want to emulate Flynn and save the universe from inside your computer, then maybe this is the game for you. After a few sessions, flying Concorde should be a piece of cake!

Talking back

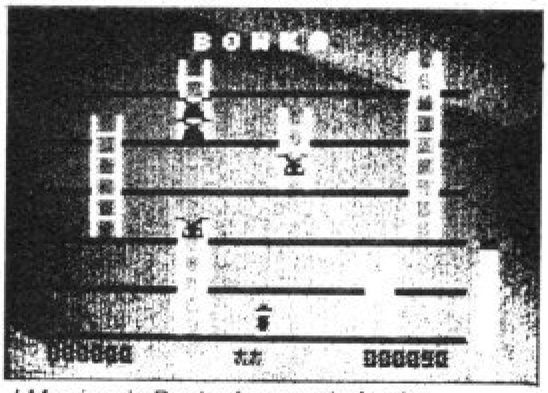
After a game that uses tape for its computer voice, one that promises us "the first of a new generation of fast action, talking arcade games". Microdeal distributes Android Attack, a variant of Berserk from Spectral Associates in the States. This is one of the better programs from Microdeal, and offers some improvements on the usual game. As your tiny figure rushes through a maze of electrified walls, it is pursued by the androids of the title who can destroy by touch or by laser fire. When zapped by your weapon, they turn into mines, and later into ghost androids that slide harmlessly through the walls. As a bonus, you can attempt to pick up crowns from each room.

If you destroy all the androids on the screen, the next display is more difficult. The speech synthesis is limited to "Intruder Alert" and "Coward" as you run from a room, but it does grate out "I'll get you next time" if you clear the screen. After my previous criticisms of Microdeal's adventure games, it is pleasant to be able to recommend this game as fun to play and good value for money.

Another arcade-type game that is quite addictive is Bonka from J Morrison. The display shows six levels connected by six ladders that appear at random. Using the cursor control keys, you control a small man whose purpose is to lure some blue meanies close to you. Digging a hole with



Wintersoft's Ring of Darkness



J Morrison's Bonka for arcade freaks

the space bar allows you to trap your enemies within, and allows you a few seconds to race to the hole and "bonk" the meany on the head. You can choose the speed of play from 1 to 4 (4 is so fast as to verge on the impossible) and also the number of meanies at the start. This is a well-graded game, providing skill levels from very easy to extremely hard, and automatically increases in difficulty as you improve. This is another good investment for the home arcade player.

To complete this month's selection, I have included two computerised board games: Backgammon from Microdeal and Cyrus Chess from Dragon Data.

Backgammon starts by giving you a menu of options. You can play against the computer, use the computer as a board while you play someone else, or watch the computer play against itself. Difficulty level can be selected, as can the option to use a light pen, to input your own dice throws and to have sound accompaniment. There are no backgammon instructions, so you will need to know how to play the game before you start. Some tips can be picked up by watching the computer play itself, particularly at level 9. The display is reasonable, but not as clear as it could be, due to the green background. As I haven't seen any other versions as yet, it is difficult to compare, but it certainly plays well and was difficult to beat at level 6. Whether this demonstrates the skill of the game or my lack is another matter!

Chess

Dragon Data's Chess program comes on a cartridge, which makes it rather expensive at £24.95. If you want a quick-loading, versatile game, then you may find this is worth extra expense. There are several options open to you, including level of difficulty, hints, automatic play, and even changing sides. The board may be set up for the solution of problems, and you can step backwards and forwards through the moves made so far. Cyrus employs two screens, a playing board showing all the pieces, and a record screen showing the moves so far, the difficulty level and the menu options available. Swopping between the two is done through the space bar, and moving pieces is simplifed by use of the cursor keys.

Standard features such as castling, pawn capture *en passant* and pawn promotion are all handled by the computer as are stalemate and checkmate positions. The Cyrus program won the Microcomputer Chess Championship in 1981.

It plays a stronger game than the two Spectrum chess programs I have, but can be beaten at the lower levels once you see the type of game it plays. Like most chess programs, it is at its weakest during the mid-game. However, this program does provide a means of improving your game and learning some of the standard openings. Hints on where to move are useful at the start, but unreliable as the game progresses. The price is rather high, but when compared to a dedicated chess computer, it still represents good value.

Lastly, for those of you anxious to improve your adventure games, here is a one-line special to enter into your Dragons:

```
10 INPUT "YOU ARE IN A DARK CAVE.
   THERE ARE EXITS N, S, E + W. . . .
   ";A$:GOTO 10
```

No prizes for the first correct solution! ■

Software reviewed this month: arcade to adventure

Dragon Data Kenfig Industrial Estate Margam Port Talbot West Glamorgan	**Madness and the Minotaur Quest Calixto Island Black Sanctum El Diablero All £7.95 Dragon Mountain £4.95 Cyrus Chess £24.95**	Wintersoft 30 Uplands Park Road Enfield, Middx	**Ring of Darkness £10.00**
		J Morrison 2 Glensdale Street Leeds	**Bonka £7.95**
		Salamander Software 27 Ditchling Rise Brighton East Sussex	**Franklin's Tomb £9.95**
Microdeal 41 Truro Road St Austell Cornwall	**Williamsburg Adventure Mansion Adventure Jerusalem Adventure Android Attack Backgammon All £8.00**	Cable Software 83 Neville Road Limbury Luton, Beds	**Drone £8.75**



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Cuthbert Goes Walkabout
CUTHBERT IS ON THE LUNAR LANDING PAD, WAITING FOR THE FEDERAL CHIEF'S STATE VISIT. HE MUST TURN THE LIGHTS ON BY WALKING ACROSS THE SWITCHES, LOCATED AT THE CORNERS OF THE SQUARES. BEFORE THE INVADING MORONIANS GET HIM. WATCH HIM DO HIS VICTORY DANCE BEFORE HE TACKLES THE NEXT "PAD" AND ANOTHER, LARGER, SET OF MORONIAN INVADERS. CAN YOU GET YOUR NAME IN THE HALL OF FAME? SUPERB FULL COLOUR GRAPHICS WITH ACCOMPANYING MUSIC.
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TEL: 0726 3456
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Shining a light on your Dragon

***Clive Gifford** looks at the light pens for the Dragon.*

MOST PEOPLE HAVE heard of light pens but few can give you many examples of their possible uses. But a light pen can be an extremely useful peripheral for the home computer owner — as Microdeal explains in its light pen manual: "The possible uses are tremendous, everything from menu selection, moving chess or checker pieces, to screen drawing and music playing, and it adds a new dimension to educational programs for young and old."

There are two types of light pen, the type used on computers of all sizes to determine the light intensity of a particular point of the screen, and the bar code reader type which is found at supermarket checkouts, among other places. Obviously it is the first type that is of interest to Dragon users.

Control

A light pen is basically a different form of input or control device, similar in this sense to a joystick or a keyboard, with which the operator can communicate to the computer. The light pen operates using a photo sensitive transistor which when pointed at the screen detects light from the CRT (Cathode Ray Tube). The pen only detects light when a beam of light passes within its narrow field of view. The pen's response is transmitted to the computer which then takes action according to which portion of the screen is being surveyed by the light pen at the time. This is a simple description of a light pen's operations but will suffice.

Most light pens are accurate enough to detect the differences in light intensity between colours as well as between light and dark. You could, therefore, have a menu of options displayed on the screen, each allocated its own corresponding colour code.

The light pen, when pointed at the appropriate code, could tell the computer to choose that particular option. The possibilities with a light pen are varied and exciting once the routine to detect the light differences is written. Their potential in education is large because the actual computer can be kept out of children's reach, and just a light pen and a television or monitor kept on display.

The prices of light pens for the Dragon are quite cheap in comparison to the cost of similar units for other major home computers. This may have something to do with the fact that, on the Dragon, a light pen can be plugged into one of the two joystick ports. There is no need for a special interface. The light pen can then be controlled using the JOYSTK command.

All three light pens reviewed here plugged into the right-hand joystick socket. They had other similarities: each came in very simple packaging with a cassette of software and a black pen with approximately 34 inches of cable terminating in a 5-pin DIN socket. I would have liked to see the cable considerably longer — for some applications the cable at present is not long enough.

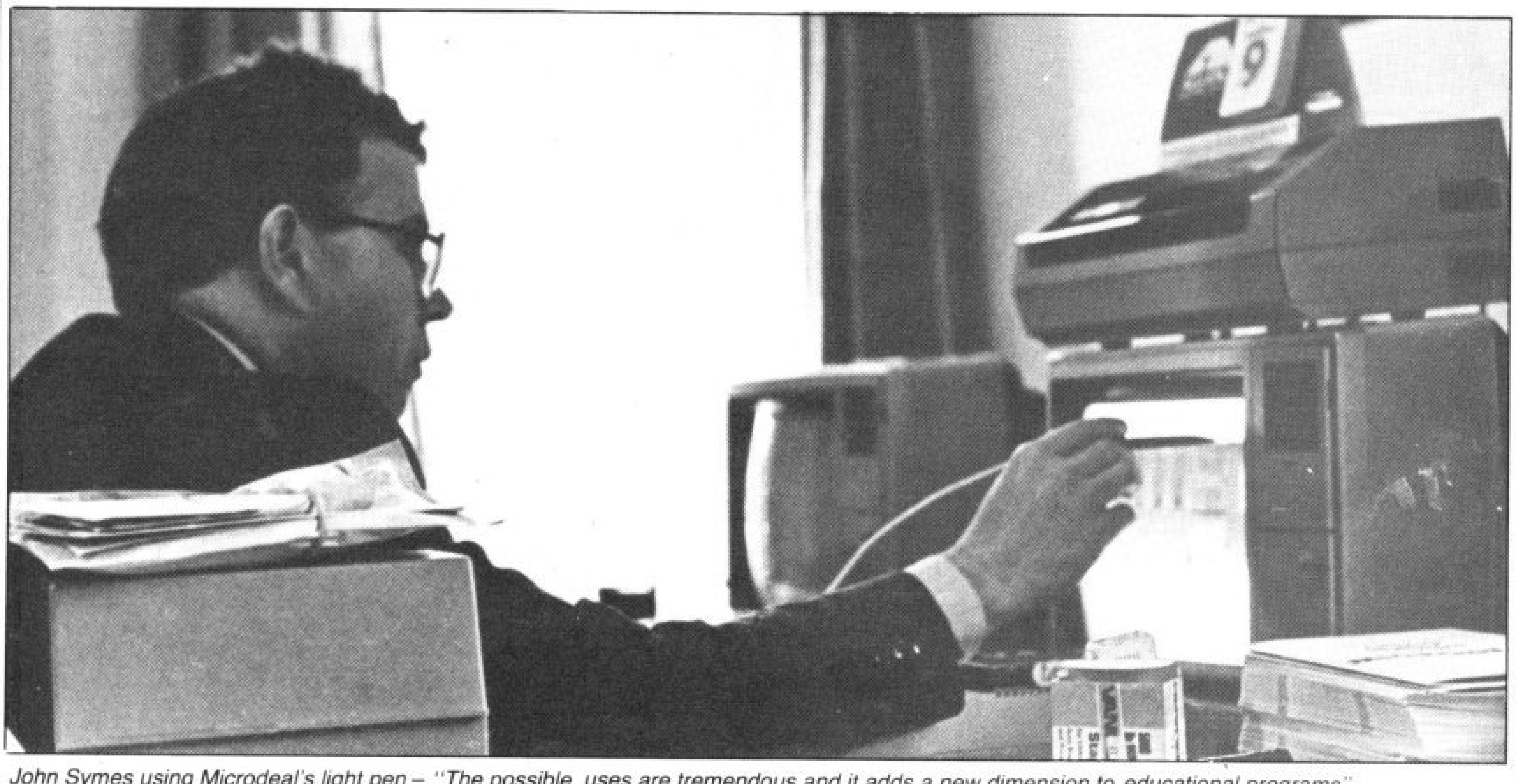
Light pens reviewed

Pen	*Price*	*Features*
Microdeal 14 Truro Road St Austell Cornwall	£12.00	Light/dark routine, colours, documentation, range of applications
Trojan Products 166 Derlwyn Dunvant Swansea	£10.00	Above routines plus comprehensive pen draw, adjustable sensitivity, speed, etc
Accord Data Church Street Great Budworth Cheshire	£9.95	Very comprehensive pen-draw features

Matchsticks

The first one that I looked at was the Trojan Products light pen retailing at £10.00 (all prices include postage and VAT). This was packaged poorly in a thin plastic wrapper and a plain cassette card. The pen itself was sturdy and had a well-made feel to it. The old phrase about not judging a book by its cover applies here because this was the best pen of the three reviewed. Once the cassette has loaded, you are presented with a colourful title page and then some good, detailed notes on the light pen. A menu is then displayed from which you must select one of the four options by using the light pen.

The sound graph and the light bar chart are weak programs which could have been better written. But the other two programs, Nim and Instructions, were very good. Nim is Trojan's version of the familiar matchsticks game but is very playable. The version is played in a different way to normal Nims and the light pen is well used in this entertaining program. Instructions,



John Symes using Microdeal's light pen – "The possible uses are tremendous and it adds a new dimension to educational programs"

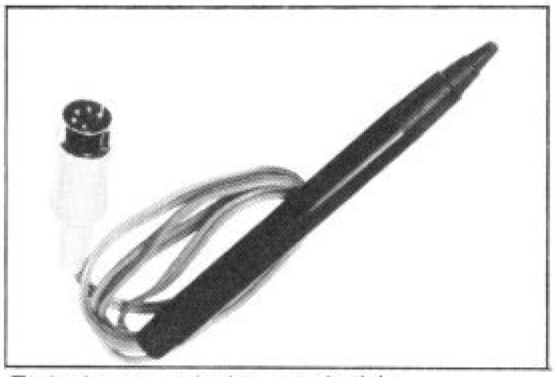
as its name suggests, is a dozen or so screenfulls of very useful information explained in an easy to understand way. This information includes the machine code addresses applicable to the light pen and the way the pen can be controlled within your own programs.

Routines

The software allowing you to use the light pen in your own programs is complex in this version. It is quite a large program but it is also the most reliable of the three. It has a sensitivity control which can be adjusted so that every time you point the pen at the correct part of the screen the computer reacts. In this version, a short tone is sounded every time the computer acknowledges a signal from the light pen. This is something that anyone can add to either of the other light pen routines and can be quite handy.

Trojan's light pen is the easiest to incorporate in one's own programs: there are many parameters that can be easily altered to give you, among other things, increased speed or a different cursor format. The pen is the most accurate and reliable of the three and the software also allows you the options of drawing a box, drawing a circle, drawing a line between two points, drawing free hand and filling a designated area in the colour of your choice.

The Microdeal pen is the most expensive of the three at £12.00. This was the only pen with any form of documentation at



Trojan's pen – playing matchsticks

all, an asset as documentation is important and should not be overlooked. The Microdeal pen promised a lot, with three programs, including a computatune and a simple routine which can be incorporated easily in any program. Unfortunately, the pen was the least reliable of the three and responded to the light source infrequently. The Microdeal manual does stress that careful tuning of all screen controls (brightness, colour and contrast) is necessary for a good response, but I found it difficult to get the right adjustments and eventually found that the pen worked better on a black and white television.

This was a shame as there are more possibilities for this pen's use than for the other two: Microdeal has already released a backgammon game which can be controlled by a light pen. The routine, well in fact there are two small routines, is quite simple and perhaps a little work on these will improve reliability. The Microdeal light pen includes a listing of the demonstration program so that you can see its workings more easily — a very helpful idea.

The light pen from Accord Data International has a more specific use as it comes with just one program, a pen-draw package. This program is quite comprehensive. Its features include the saving of screen pictures on tape, increasing speed and changing colour, but I found that it was not much better than other keyboard or joystick operated artist programs.

It's a shame that Accord Data did not include a light scanning routine similar to one of the other two pens as this would have increased its range of applications enormously. The light pen does work on other companies' software so it should not be too difficult to write a suitable routine but I think that Accord Data should have widened the scope of its pen. However, the company is repackaging its pen to include more instructions and a more attractive design.

Pricing

In conclusion, all the pens are similarly styled and packaged without quality documentation. The prices, however, are well below those of pens for other computers. The most complete package came from Trojan Products, whose pen combined with quality software provides a handy package for someone new to the art of light pen use. The Accord Data pen was a nice affair, only lacking in software, and by 5p was the cheapest. The Microdeal pen has the most potential for use but fell down on reliability. ■



Compusense flexes its Dragon skills

*The Opyrchal brothers fell for the 6809 – **Graham Cunningham** talks to them about their admiration for the chip at the heart of the Dragon 32.*

IF YOU'VE spent more than 25 years in mainstream computing, including working with mainframes from the two biggest firms in the UK, where do you go next? If you're the Opyrchal brothers, the answer is into your own business in north London, specialising in Dragon 32 software.

The name of the business is Compusense — the partners are Ted and Stan Opyrchal, and Ted's wife Barbara.

Ted had spent more than 10 years working with computers before he founded Compusense in November 1979, so the firm is now coming up to its fourth birthday. His experience was in large commercial installations, including work for BP in the Middle East, on mainframes from ICL and Univac. This brought him into contact with most programming languages.

Stan was one of the first UK graduates in computing and he went on to the wider field of communications, leaving IBM a year ago to join Ted at Compusense's offices in Palmers Green.

The frustration and restrictions of "working for rule bound computer installations"

But his 15 years of experience have not dulled his enthusiasm. He recently sent *Dragon User* a routine which dumps the contents of the high resolution screen to an Epson FX-80 printer. At the time he said: "I doubt whether a simpler graphics screen dump program can be written in Basic. If any readers would be interested in a similar program written in machine code I would be happy to accept the challenge."

Ted's enthusiasm is equally strong. He commented on the restrictions of "working for rule-bound computer installations" — it was this "sense of frustration" which led him to start Compusense.

Another motivation was the two brothers' admiration for the 6809 chip, the central processing unit at the heart of the Dragon 32. As Ted says: "We saw the 6809 specification and thought it was wonderful."

One of the main rivals to the 6809 is the Z80 on which the Spectrum is based. Ted thinks that comparing the two is like comparing a custom-designed car with a souped-up Mini, with the 6809 emphatically being "the best 8-bit chip". Ted explained: "Internally the 6809 is a 16-bit processor designed to do 16-bit instructions." So it wins for its instruction set, faster execution and the fact that it is "nicer to use for programming".

Until the Dragon was launched last year, there was no volume 6809 machine in Europe. Ted commented: "It only needed one firm to do it to create an explosive market." He's pleased to see the "6809 getting a chance" and thinks the Dragon 32 is "excellent value for money".

"With a little bit more design effort the machine could have been better"

But he has some reservations: "With a little bit more design effort the machine could have been better than Tandy's Colour Computer." Stan's particular praise went to the Microsoft Extended Colour Basic: "It's very good, the same as is used in the IBM PC."

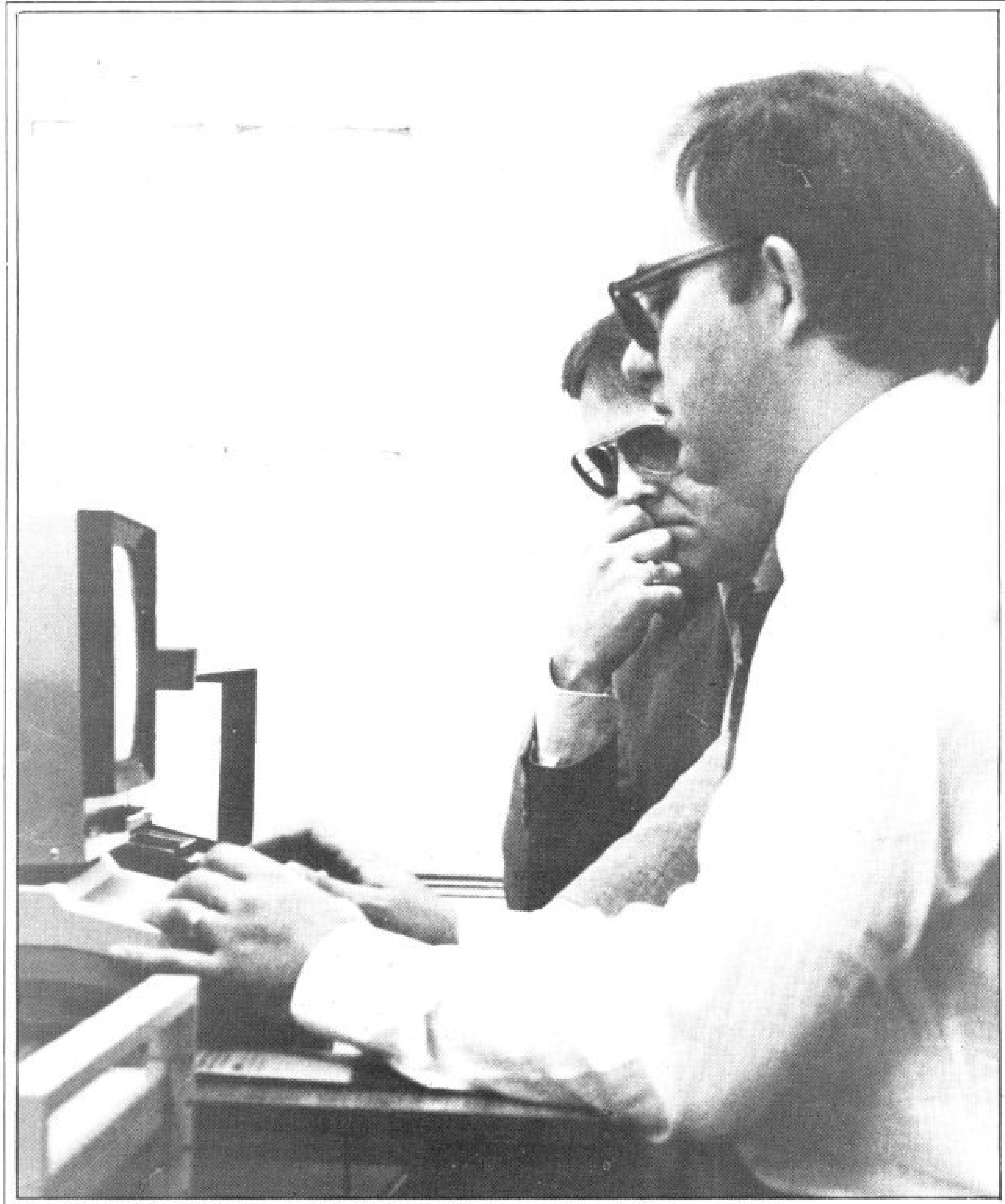
But in 1979 there were no Dragon 32s, so Compusense began by supporting software and hardware in South West Tech's 6800 range. Much more expensive than the Dragon 32, the systems from this company cost from £2,000 to £50,000. Compusense still imports boards allowing South West Tech users to expand their systems' performance.

And it also sells a complete 6809 system which supports up to one megabyte of memory. As Ted points out this is an ideal machine on which to develop Dragon software, and other firms such as Quicksilva have been round to see how it works.

The system also supports the Flex and OS9 operating systems — which Dragon Data intends to be offering on its micros this year. OS9 will run on the Dragon 64 which is expected to be available in September. Flex will follow on an as yet unnamed micro which should be out at the end of this year retailing at about £400.

One of the best things about these two operating systems, according to Ted, is that the people working in this market are "a nice community of small firms".

Ted also thinks that it is "very difficult to praise Flex highly enough" and that it is the best operating system for Dragons. He points out that it is "well documented and ►



Stan (left) and Ted Opyrchal – saw the 6809 specification and thought it was wonderful

◀ easy to handle for a single user".

Its more established rival, CP/M, is "very dated and difficult to use". But Flex "has a problem with upward compatibility" and all its major system functions are written in RAM. OS9, on the other hand, has its functions written in ROM and has a clear upgrade path. Level 1 has limited multitasking and Level 2 is multiuser.

OS9 has already been tried on 68000 16-bit machines, although here it is entering a bigger league — a 68000 costs as much as a Dragon 32 at the moment. Consequently other operating systems such as Unix are regarded as more appropriate.

When Flex and OS9 are running on Dragons, Compusense will be ready with "lots of application packages", including database managers and financial spreadsheets. Exactly how many "depends on the amount of memory Dragon Data leaves in the machine and how well arranged it is".

Scheduled for this year are a word processing editor and then a Basic compiler

Compusense is also considering packages to run on Dragon Data's own operating system, used on the drives for the Dragon 32. Transferring software to run on the already available Premier disk systems is another possibility.

The company already sells a range of games and utilities for the Dragon 32. The games, the most popular of which are Space Race and Poker, come from Spectral Associates in the US. This Washington-based company also supplies Dragon Data. But the utilities cartridges are all written in-house by the two brothers. Ted thinks that this is one of their strongpoints. He pointed out that "a lot of other utilities are written for bigger computers and don't transfer well".

At the moment the best-selling cartridges are Dasm, a machine code assembler, and Hi-Res which gives a 51-column by 24-line display with lower case characters. Ted puts their popularity down to the fact that they are the "two most immediately useful packages — Hi-Res has obvious business applications". And sales are going well abroad too, with Hi-Res selling strongly in France.

The other two cartridges available at the moment are Demon, a machine code monitor, and Decode, for converting Tandy Colour Computer programs to the Dragon 32. Combination cartridges are also supplied. For example, a full screen editor which can be combined with Hi-Res is planned for this summer and Dasm/Demon is already available. Also scheduled for this year are a word processing editor and a Basic compiler.

Don't be surprised to see hard disks arriving from Compusense later on

Within six months of buying single cartridges, users can purchase the combined versions if they pay the difference in price and a handling fee.

Within the same period, Compusense is also offering free software upgrades to users of its packages. "After six months upgrades would be more significant," Ted added, "so we must charge."

He stressed that maintaining existing products was important to Compusense: "We intend to continue providing a high level of after-sales support because utilities packages have a long life-time." As part of this commitment the company intends to start a newsletter soon.

Compusense is sticking to its policy of only offering utilities on cartridge. Stan explained that you could do more in software than boards and Ted added that security and stability made them prefer cartridges to cassettes. As he explained: "Cartridges are obviously less easy to copy but they are also more reliable and save memory space inside the machine."

While Ted stresses that Compusense is a software house, adding, "We're programmers not electronics engineers", the firm has considered producing Dragon peripherals. Last year the brothers developed a Dragon disk drive system running Flex, with a memory upgrade to 64K, twin drives and an RS232 interface. They considered the system was "too advanced for the market" and decided not to sell it. But they still have an eye on the memory market — don't be surprised to see hard disks for the Dragon emerging from Potters Green. ■

Solve the riddle of the rings

*A change of pace from blitzing and space games – **R Chybalski** introduces an ancient Hindu legend.*

LEGEND TELLS THAT the ancient Hindu deity Brahma set the following problem for his followers to solve: it was to transfer a pile of rings of varying sizes from one of three columns to another. At no time was a ring to be placed on top of a smaller one; rings were only to be transferred one at a time.

The listing below presents this problem on a Dragon 32. It includes routines to make sure that only correct moves are made. All one has to type in to transfer a ring is the letter of the 'from' column followed by the letter of the 'to' column. Using just two keys for the transfer enables fast user operation (photos: the Government of India Tourist Office).

Main variables

NR — Number of rings
SZ — Size of ring
T — Time taken (seconds)
RI(x,y) — Ring position (row, column)
AF$ — 'from' column
AT$ — 'to' column

Program notes

10- 30	Print rules
40- 80	Get number of rings to be used
90-160	Draw LR graphics screen
170-190	Draw rings on column 'A'
200-230	Get 'from' pillar
240-270	Get 'to' pillar
280-360	Determine ring size and blank it out on 'from' pillar
370-460	Place ring on 'to' column
470-500	Test for success in solving problem
510-530	Delay / Increment Timer / Loop for next move
540-570	Resignation routine — Print time
580-650	Ring larger than one below — Put it back
660-710	'from' column empty
720-770	Successful solution routine — Print time
780-980	Ring drawing routines



```
10 CLS:PRINT@38,"THE TOWERS OF BRAHMA":T
=0
20 PRINT@128,"THE OBJECT IS TO TRANSFER
THE","RINGS FROM PILLAR a TO PILLAR","c.
 ONE AT A TIME, BUT AT NO TIMEHAVING A L
ARGER RING ON TOP OF ASMALLER ONE."
30 PRINT:PRINT"TO TERMINATE TYPE 'S'"
40 PRINT:PRINT"HOW MANY RINGS WOULD YOU
LIKE","(5-8)?"
50 AA$=INKEY$:IFAA$=""THEN50
60 IFAA$<"5"THENPRINT"TOO SMALL!!":GOTO4
0
70 IFAA$>"8"THENPRINT"TOO LARGE!!":GOTO4
0
80 NR=VAL(AA$):DIMRI(9,3):CLS0
90 RI(9,1)=9:RI(9,2)=9:RI(9,3)=9
100 PRINT@38,"THE TOWERS OF BRAHMA";
110 PRINT@70,"====================";
120 FORA=1TO8
130 PRINT@(32*A+133),"A";:PRINT@(32*A+14
3),"B";:PRINT@(32*A+153),"C";:NEXT:PRINT
@416,CHR$(140);
140 FORA=1TO31:PRINTCHR$(140);:NEXT
150 PRINT@452,"from";:PRINT@457,CHR$(143
);
160 PRINT@472,"to";:PRINT@475,CHR$(143);
:NS=9-NR
170 FORA=NS TO8:RI(A,1)=A:NEXT
180 FORA=NS TO8:X=A:Y=1:GOSUB780
190 NEXT:TIMER=0
```

```
200 AA$=INKEY$:IFAA$=""THEN200
210 IFAA$="S"THEN540
220 IFAA$<"A"ORAA$>"C"THEN200
230 AF$=AA$:PRINT@457,AF$;
240 AA$=INKEY$:IFAA$=""THEN240
250 IFAA$="S"THEN540
260 IFAA$<"A"ORAA$>"C"THEN240
270 AT$=AA$:PRINT@475,AT$;
280 IFAF$="A"THENYB=1
290 IFAF$="B"THENYB=2
300 IFAF$="C"THENYB=3
310 XB=1
320 IFRI(XB,YB)<>0THEN350
330 XB=XB+1:IFXB=9THEN660
340 GOTO320
350 SZ=RI(XB,YB):X=XB:Y=YB:GOSUB800
360 RI(XB,YB)=0
370 IFAT$="A"THENYA=1
380 IFAT$="B"THENYA=2
390 IFAT$="C"THENYA=3
400 XA=1
410 IFRI(XA,YA)<>0THEN440
420 XA=XA+1:IFXA=9THEN440
430 GOTO410
440 X=XA-1:Y=YA:GOSUB790
450 RI(X,Y)=SZ:A9=0
460 IFRI(XA,Y)<RI(X,Y)THEN580
470 FORA7=1TO8
480 IFRI(A7,3)=A7 THENA9=A9+1
490 NEXTA7
```

lle





```
500 IFA9=NR THEN720
510 FORA7=1TO250:NEXTA7
520 PRINT@457,CHR$(143);:PRINT@475.CHR$(
143);
530 T=T+(TIMER/50):TIMER=0:GOTO200
540 CLS0:PRINT@128,"WHAT A PITY! YOU HAV
E GIVEN UP!"
550 T=T+TIMER/50:MI=INT(T/60):SE=INT(T-M
I*60)
560 PRINT:PRINT"IT HAS TAKEN YOU";MI;"MI
NUTES","AND";SE;"SECONDS TO GET SO FAR."
570 END
580 PRINT@480,"RING LARGER THAN THAT BEL
OW!";
590 FORA9=1TO1500:NEXTA9
600 FORA9=1TO30
610 PRINT@(479+A9),CHR$(128);:NEXTA9
620 RI(X,Y)=0:GOSUB800
630 X=XB:Y=YB:RI(X,Y)=SZ
640 GOSUB790
650 GOTO520
660 PRINT@480,"COLUMN ";AF$;" EMPTY!";
670 FORA9=1TO1500:NEXTA9
680 FORA9=1TO24
690 PRINT@(479+A9),CHR$(128);:NEXTA9
700 PRINT@457,CHR$(143);:PRINT@475,CHR$(
143);
710 GOTO200
720 CLS0:PRINT@128,"CONGRATULATIONS!"
730 T=TIMER/50+T:MI=INT(T/60):SE=INT(T-M
I*60)
740 PRINT"YOU HAVE SOLVED THE ANCIENT","
PUZZLE OF THE SUPREME HINDU GOD!"
750 PRINT:PRINT"IT ONLY TOOK YOU :-"
760 PRINTMI;"MINUTES AND";SE;"SECONDS."
770 END
780 SZ=RI(X,Y)
790 ON(SZ+1)GOTO800,830,850,870,890,910,
930,950,970
800 PRINT@(119+32*X+10*Y),CHR$(128);CHR$
(128);CHR$(128);CHR$(128);
810 PRINT@(124+32*X+10*Y),CHR$(128);CHR$
(128);CHR$(128);CHR$(128);
820 RETURN
830 PRINT@(122+32*X+10*Y),CHR$(213);
840 PRINT@(124+32*X+10*Y),CHR$(218);:RET
URN
850 PRINT@(122+32*X+10*Y),CHR$(159);
860 PRINT@(124+32*X+10*Y),CHR$(159);:RET
URN
870 PRINT@(121+32*X+10*Y),CHR$(165);CHR$
(175);
880 PRINT@(124+32*X+10*Y),CHR$(175);CHR$
(170);:RETURN
890 PRINT@(121+32*X+10*Y),CHR$(207);CHR$
(207);
900 PRINT@(124+32*X+10*Y),CHR$(207);CHR$
(207);:RETURN
910 PRINT@(120+32*X+10*Y),CHR$(133);CHR$
(143);CHR$(143);
920 PRINT@(124+32*X+10*Y),CHR$(143);CHR$
(143);CHR$(138);:RETURN
930 PRINT@(120+32*X+10*Y),CHR$(191);CHR$
(191);CHR$(191);
940 PRINT@(124+32*X+10*Y),CHR$(191);CHR$
(191);CHR$(191);:RETURN
950 PRINT@(119+32*X+10*Y),CHR$(229);CHR$
(239);CHR$(239);CHR$(239);
960 PRINT@(124+32*X+10*Y),CHR$(239);CHR$
(239);CHR$(239);CHR$(234);:RETURN
970 PRINT@(119+32*X+10*Y),CHR$(255);CHR$
(255);CHR$(255);CHR$(255);
980 PRINT@(124+32*X+10*Y),CHR$(255);CHR$
(255);CHR$(255);CHR$(255);:RETURN
```

Putting a spring into movement

***Margaret Norman** shows you how to develop movement routines for the Dragon — and then introduces a simple but exciting game.*

MOST COMPUTER GAMES involve the player moving an object (bat, spaceship, frog or whatever) on the screen, using the keyboard or a joystick. The various ways in which this movement can be controlled within the game program can be most easily examined and compared by considering the simplest possible example — the movement of a black square on the low-resolution screen.

There are several stages to be gone through in a program to move the square. First the screen must be cleared, the initial X and Y co-ordinates of the square defined, and the square POKEd on to the screen at these co-ordinates. The old values of X and Y must be preserved (here in variables A and B), then the input from the keyboard or joystick must be read and new values of X and Y calculated; these values must be checked to ensure they are within the screen limits (0-31 for X, 0-15 for Y) before POKEing a green square over the old black square and finally POKEing a new black square on to the screen.

Common

The following lines (*Listing 1*) are common to all the variations of the program considered here:

```
110 CLS
120 X=15: Y=10
130 POKE(1024+X+32*Y),128
140 A=X: B=Y
....................
500 POKE(1024+A+32*B),143
510 GOTO 130
```

The lines used to check that the values of X and Y lie within the screen limits will depend on whether the square is to stop at the screen edges, or to wrap around the screen. For movement to stop at the edges, use (*Listing 2A*):

```
400 IF X<0 THEN X=0
410 IF X>31 THEN X=31
420 IF Y<0 THEN Y=0
430 IF Y>15 THEN Y=15
```

For wraparound movement, the numbers must be changed around (*Listing 2B*):

```
400 IF X<0 THEN X=31
410 IF X>31 THEN X=0
420 IF Y<0 THEN Y=15
430 IF Y>15 THEN Y=0
```

The rest of the program will depend on whether the keyboard or a joystick is to be used, and on the type of movement required.

For keyboard control, the first task is to determine which keys are to be used. These may be fixed within the program, or the player can be asked to choose for himself. For this, these lines must be added (*Listing 3A*):

```
10 INPUT "KEY FOR LEFT";L$
20 INPUT "KEY FOR RIGHT";R$
30 INPUT "KEY FOR UP";U$
40 INPUT "KEY FOR DOWN";D$
```

Note that this method cannot be used for the arrow keys. If these are to be used they must be defined within the program by (*Listing 3B*):

```
10 L$ = CHR$(8):R$ = CHR$(9):U$ =
   CHR$(94):D$ = CHR$(10)
```

The next decision to be made is whether to use the INKEY$ function, or to use PEEK to determine which keys are being pressed. INKEY$ is probably the simplest method to use, and yet allows a surprisingly wide choice of different types of movement. Several different listings using INKEY$ will be shown here, and the effects of each will be considered.

Here is the first listing — type this in with *Listings 1, 2A* or *2B*, and *3A* or *3B*, and you can try running the program (*Listing 4*):

```
300 A$=INKEY$: IF A$="" THEN 300
310 X=X+(A$=L$) - (A$=R$)
320 Y=Y+(A$=U$) -- (A$=D$)
```

You should find that the black square will move one place whenever one of the selected keys is pressed. (The brackets in lines 310 and 320 have a value of −1 if true and 0 if false, so either X or Y will be increased or decreased by 1.)

Distances

Holding a key down has no effect when INKEY$ is used; the key must be released and pressed again for the movement to be repeated. This listing therefore has obvious limitations if an object may need to be moved considerable distances. The number of key-presses required can be reduced, by making the movement of the square continuous, if line 300 is changed, leaving the other lines in *Listing 4* unchanged (*Listing 4A*):

```
300 C$=INKEY$: IF C$<>"" THEN
    A$=C$
```

Now once a key has been pressed the black square should continue moving in the direction set by that key until another key is pressed. If you press a key which does not have a direction assigned to it, you should find that the black square will stop moving. If you want to ensure continuous movement, then these alterations to the program should do the trick, leaving lines 310 and 320 as *Listing 4* (*Listing 4B*):

```
15 B$=L$+R$+U$+D$
300 C$=INKEY$: IF C$<>"" AND
    INSTR(1,B$,C$)<>0 THEN A$=C$
```

So far it has only been possible to move the square horizontally and vertically. Diagonal movement, ie simultaneous horizontal and vertical movements, requires the introduction of two new variables, H and V (*Listing 5*):

```
300 A$=INKEY$
310 H=H+(A$=L$ AND H>-1) -
    (A$=R$ AND H<1)
320 V=V+(A$=U$ AND V>-1) -
    (A$=D$ AND V<1)
330 X=X+H
340 Y=Y+V
```

Note that the brackets in lines 310 and 320 now each contain two conditions, and will have a value of −1 only if both are satisfied.

This is an easy way of ensuring that H and V can only have values of −1, 0 or 1. If H or V is equal to −1 then the square will move left or up respectively, and similarly if H or V is equal to 1 the square will move right or down. As H and V can both be non-zero, the square can now be moved diagonally. It can also be stopped — can you think of a way of altering this listing to ensure continuous movement? It's not as simple as you might expect.

The final example using INKEY$ allows the square to be moved horizontally or vertically, but will not permit reversal of direction, only right-angled turns — you will find a variation of this in some caterpillar-type games (*Listing 6*):

```
300 If F=1 THEN 340
310 C$=INKEY$: IF C$=U$ OR C$=D$
    THEN A$=C$: GOTO 350
320 X=X+(A$=L$) - (A$=R$)
330 F= 0: GOTO 400
340 C$=INKEY$: IF C$=L$ OR C$=R$
    THEN A$=C$: GOTO 320
350 Y=Y+(A$=U$) - (A$=D$)
360 F=1
```

Keyboard

The Dragon scans its keyboard regularly to find out which keys are depressed; the results of these scans are stored in memory locations 338 to 345. The memory locations and numbers obtained for each key are shown in the following table: ▶

```
50 CLS
60 PRINT@12,"CHASE":PRINT
70 PRINT "  MOVE THE BLACK SQUARE WITH THEARROW KEYS, AND TRY TO CATCH THERED SQ
UARE."
80 PRINT"  THERE ARE TEN RED SQUARES TO  CATCH, AND THERE IS A TIME LIMITON EACH
 - IF YOU RUN OUT OF TIMEYOU WILL HEAR A BEEP AND THE     NEXT RED SQUARE WILL AP
PEAR"
90 PRINT:INPUT"PRESS 'ENTER' TO START";Q$
100 FOR N=1 TO 10
110 CLS
120 X=0:Y=0:XR=15:YR=10
125 IF (X=XR AND Y=YR) THEN 600
130 POKE(1024+X+32*Y),128
140 A=X:B=Y
150 AR=XR:BR=YR
160 XR=XR+(RND(3)-2)
170 YR=YR+(RND(3)-2)
180 IF XR<0 THEN XR=0
190 IF XR>31 THEN XR=31
200 IF YR<0 THEN YR=0
210 IF YR>15 THEN YR=15
220 POKE(1024+AR+32*BR),143
230 IF (XR=X AND YR=Y) THEN 600
240 POKE(1024+XR+32*YR),143+48
250 M=M+1:IF M=100 THEN 690
300 X=X+(PEEK(343)=223)-(PEEK(344)=223)
310 Y=Y+(PEEK(341)=223)-(PEEK(342)=223)
400 IF X<0 THEN X=0
410 IF X>31 THEN X=31
420 IF Y<0 THEN Y=0
430 IF Y>15 THEN Y=15
500 POKE(1024+A+32*B),143
510 GOTO 125
600 SC=SC+(100-M)
610 SOUND 200,5
620 FOR F=1 TO 3
630 SCREEN0,1:FOR D=1 TO 50:NEXT D:SCREEN0,0:FOR D=1 TO 50:NEXT D
640 NEXT F
650 GOTO 700
690 SOUND 50,1
700 M=0:NEXT N
710 CLS:PRINT@70,"SCORE = ";SC
720 PRINT:INPUT"ANOTHER GAME (Y/N)";R$
730 IF R$<>"N" THEN RUN
740 END
```

Chase – the game involves pursuing a randomly moving square with another

	338	339	340	341	342	343	344	345
254	0	1	2	3	4	5	6	7
253	8	9	:	;	,	-	.	/
251	@	A	B	C	D	E	F	G
247	H	I	J	K	L	M	N	O
239	P	Q	R	S	T	U	V	W
223	X	Y	Z	↑	↓	←	→	space
191	enter	clear						

These numbers only apply if only one key is depressed at a time. Try entering:

5 PRINT PEEK(341),PEEK(342): GOTO 5

When you RUN this, the screen should show two columns of numbers; if no keys are depressed, the number shown in each column should be 255. Press the up arrow, and the number in the left-hand column should change to 223. Now release the up arrow, and press the down arrow; the left-hand column should show 255 and the right-hand column, 223. Now press the up arrow again, while keeping the down arrow depressed; the numbers will not change. Release the down arrow, and they will still not change. Only if one key is released *before* another is pressed will the numbers shown in the table be obtained. Because of this, you may find it best to play games using keyboard PEEKs with only one finger.

Try this listing using PEEKs, with *listings 1* and *2A* or *2B* (after erasing line 5):

300 X = X + (PEEK(343) = 223) − (PEEK(344) = 223)
310 Y = Y + (PEEK(341) = 223) − (PEEK(342) = 223)

The arrow keys are used to move the square, but *listing 3B* is not needed. The square should move left, right, up or down as long as the relevant key is depressed.

The great advantage of joysticks, however, is that they can be used to make objects move in any direction, not just along straight lines. The Dragon JOYSTK functions return values of between 0 and 63, depending on the position of the joystick. These values can be used in two very different ways to control the movement of our black square.

The first listing relates the position of the square directly to the position of the joystick, so the square will hop around the screen as the joystick is moved. This should be used with just *listing 1; listing 2A/B* is not necessary:

300 X=INT(JOYSTK(0)*31/63)
310 Y=INT(JOYSTK(1)*15/63)

The functions JOYSTK(0) and JOYSTK(1) used here refer to the right joystick. If only one joystick is to be used in a program, it should be the right one which is used; the functions JOYSTK(2) and JOYSTK(3) which give the position of the left joystick will only return non-zero values if JOYSTK(0) and JOYSTK(1) are also being used. Test this by replacing JOYSTK(0) in line 300 by JOYSTK(2), and JOYSTK(1) in line 310 by JOYSTK(3); you should find that the black square will now move diagonally left and up regardless of the position of the left joystick.

Control

However, if you insert into the program:

195 J=JOYSTK(0): K=JOYSTK(1)

(a line which has no purpose other than to introduce the other JOYSTK functions), the left joystick will control the movement of the square. The right joystick need not even be plugged in for this to work — it is not the right joystick itself that we need, only its functions.

The other listing uses the JOYSTK functions in much the same way as the INKEY$ function and keyboard PEEKs were used. This should be used with *listings 1* and *2A* or *2B*.

300 X = X + (PEEK(343) = 223) − (PEEK(344)=223)
310 Y = Y + (PEEK(341) = 223) − (PEEK(342)=223)

The effect is very similar to that of *listing 6* — the square can be moved horizontally, vertically or diagonally.

The listings given here do not cover all the possibilities — plenty more variations are possible — but if you study them carefully, and alter them where necessary, you should be well on the way to getting your games to move how you want them to.

Finally, let's look at how these movement routines can be used in a game program. The Chase game which accompanies this article uses *listings 1, 2A* and *7*, but you can substitute any of the other combinations of listings discussed here if you wish. (Lines 120 and 510 of *listing 1* have been altered slightly.)

The game involves chasing a randomly moving red square with the black square. It starts with a short instruction sequence (lines 60-80); line 90 has been put in to hold the instructions on the screen until they have been read. Next a loop is set up (lines 100 to 700) to repeat the main part of the game 10 times. The start positions of the two squares are established in line 120, with the black square in the top left-hand corner of the screen and the red square in the centre.

The lines controlling the movement of the red square mirror those for the black square, except for lines 160 and 170, where the changes in the X and Y co-ordinates (XR and YR) are determined randomly — (RND(3)−2) will give a value of −1, 0 or +1. Two lines (125 and 230) have been put in to compare the co-ordinates of the squares and see if they have collided; in a more complex game, with more than one target, screen PEEKs would be used for this.

The movements of the red square are counted (line 250) and used to fix a time limit and to determine the score (line 600). The hit sequence (lines 610 to 640) makes a high-pitched sound and flashes the screen three times — the delay loops in line 630 have been put in to slow the flashes down and make them visible. (An interesting point to note is that the paths of the squares show up when the screen flashes — the computer distinguishes between the green background and the green squares which have been POKEd on to the screen.)

There is a low-pitched sound if the red square has not been caught within the time limit (line 690). The program ends with the score being displayed, and the player asked if he would like another game.

This game is very basic as it stands, but could quite easily be "dressed up" if you wish. The squares could perhaps be replaced by spaceships (DRAW them on the high-res screen, then use GET and PUT to move them against a black background), or by anything else you fancy; the target could be made to take evasive action instead of moving randomly. ■



TONY HALL
SHIFT
Z

Finding out what Dragon memory has in store

If you've ever wondered how data is stored in the Dragon's memory, ***Rodney Jones*** *has the answer.*

ALTHOUGH MOST DRAGON 32 users will take only a passing interest in machine code programming and the 6809E microprocessor which is at the heart of their machine, at some time or other every one of them will wonder how the program that they have so carefully typed in, and the date used by that program, are stored in the Dragon's memory. This article sets out to give an answer to this, and to suggest ways in which the Dragon's system can be investigated by the dedicated fan.

In order to investigate how the Dragon stores a program it is first necessary to write a program. Before typing in the program in *listing 1*, switch the Dragon off and then on again. This is important since the location at which a program is stored is influenced by the number of pages that are reserved for the high-resolution graphics screen, and switching the computer off and on ensures that the default of four pages is used.

The strategy which we shall adopt is simple. We store a program in memory and then look at the memory locations used to see what is actually stored there.

Lines 30-80 of the program are included simply so that the program actually does something: in this case prints the numbers from 1 to 100. We could equally have written lines which would have computed the square roots of prime numbers, or calculated a Great Circle route from London to New York.

The Dragon's operating system needs to keep track of lots of information when it is running a Basic program. Among these is the location at which the program begins and the location at which it ends. This information is stored by the system in locations 25 to 28. Since these addresses will be greater than 255, two bytes are required for each address. Location 25 stores the high-byte of the start address while location 26 stores the low-byte. Similarly location 27 stores the high-byte of the end address and location 28 stores the low-byte. Actually the latter address is that of a pointer which is two bytes to the right of the end of the Basic program and consequently we hve to knock-off two bytes. Lines 1000-1020 look-up these addresses and display them.

At this point let us run the program and see what happens. After seeing each number from 1 to 100 displayed, you should get a message saying that "THE PROGRAM STARTS AT LOCATION 7681 AND ENDS AT 8271."

So, why does the program start at location 7681? The reason is the high-resolution screens that the Dragon uses. You will be aware that when the Dragon is switched on four pages of memory are reserved for the high-resolution graphics screens. This memory allocation is actually locations 1536 to 7679, a total of 6143 bytes. A program which is stored now will commence at the location two bytes to the right of the end of the last reserved page, 7679+2=7681 — which is the address given by the display.

Clearing

We can change the amount of memory allocated to the high-resolution screens by using the PCLEAR statement. Press the BREAK key and type in "PCLEAR2". RUN the program again. The message now says that the program starts at location 4609. If you repeat this procedure with each number from 1 to 8 you will find the starting addresses given in the following table.

PCLEAR	*START ADDRESS*
1	3073
2	4609
3	6145
4	7681
5	9217
6	10753
7	12289
8	13825

Now that we have the starting address of our program we can move on to the second part of the program. The lines from 1050 to 1130 look at each location from the start address to the end address and print the address, the decimal contents of the address, the contents of the address in hexadecimal and the character representation of the contents of the address.

This may sound complicated but as you will see it is quite simple. Type in "PCLEAR4" and RUN the program. After the message giving the starting location has been displayed, press any key and the first 'screen-ful' of information is given. If you again press any key you will get the next 13 locations, and so on. Let us consider the first two pages which are reproduced below:

MEM	*DEC*	*HEX*	*CHR*
7681	30	1E	
7682	17	11	
7683	0	0	
7684	10	A	
7685	130	82	
7686	32	20	
7687	76	4C	L
7688	73	49	I
7689	83	53	S
7690	84	54	T
7691	73	49	I
7692	78	4E	N
7693	71	47	G
7694	32	20	
7695	49	31	1
7696	0	0	
7697	30	1E	
7698	23	17	
7699	0	0	
7700	20	14	
7701	160	A0	
7702	0	0	
7703	30	1E	
7704	44	2C	
7705	0	0	

Where the address does not contain a meaningful character-code, I have not completed the final column.

The contents of locations 7681/7682 form a 2-byte address. In all cases with the 6809E processor the first location contains the high-byte and the second contains the low-byte. The address is calculated with the formula:

Address = 256*High Byte + Low Byte

Applying this formula to location 7681 (which contains '30') and to location 7682 (which contains '17') gives:

30*256+17=7697

which is the address at which the next Basic line starts.

Applying our formula to the contents of locations 7683/7684 gives:

0*256+10=10

and this is the line number of the first Basic statement in our program.

The Basic interpreter refers to the words of the Basic language by means of tokens.

Listing 1 – switch the Dragon off and then on before typing this in

```
10 REM LISTING 1
20 CLS
30 PRINT @36,STRING$(24,128)
40 PRINT @74,"LISTING 1"
50 PRINT @100,STRING$(24,128)
60 FOR I=1 TO 100
70 PRINT @202,"<";I;">"
80 NEXT I
1000 PRINT @256,STRING$(32,156)
1010 PRINT @321,"THE PROGRAM STARTS AT LOCATION"
1020 PRINT @353,PEEK(25)*256+PEEK(26);" AND ENDS AT ";PEEK(27)*256+PEEK(28)-2;"."
1030 PRINT @448,"!!PRESS ANY KEY TO CONTINUE!!"
1040 IF INKEY$=""THEN 1040
1050 GOSUB 2000
1060 J=1
1070 FOR I=PEEK(25)*256+PEEK(26) TO PEEK(27)*256+PEEK(28)-2
1080 IF J/13<>INT(J/13) THEN 1100
1090 IF INKEY$=""THEN 1090 ELSE GOSUB 2000
1100 PRINTUSING" £££££   £££      %%      %% ";I,PEEK(I),HEX$(PEEK(I)),CHR$(PEEK(I))
1110 J=J+1
1120 NEXT I
1130 STOP
2000 CLS
2010 PRINT"  MEM      DEC      HEX    CHR "
2020 RETURN
```

Each word has a token and the token for REM is 130. Thus location 7685 records the first Basic verb in line 10.

If you typed the program in exactly as I have listed it you will have placed a space between the words REM and LISTING. The code 20 in location 7686 is the ASCII code for SPACE. Notice that memory is used up recording spaces.

My description of location 7686 and the characters printed in the CHR column against locations 7687 to 7695 explain their contents. They are simply the ASCII codes for the letters of the word 'LISTING', a space, and the number '1'. Again it should be noted that this REM line has used 16 bytes of storage.

The system marks the end of a Basic line with a '0' in location 7696. That completes the first line of our program. As predicted by locations 7681 and 7682 the next program line commences at location 7697.

The address formula applied to locations 7697/7698 gives:
30*256+23=7703
so we know that the next program line begins at location 7703. Locations 7699/7700 record the fact that the Basic line number is 20. In location 7701 '160' is the token for CLS. And location 7702 is the end-of-line-marker.

Using the same procedure on the next locations you should satisfy yourself that the next Basic line (line 40) will be stored starting at location 7724; that the token for PRINT is 135; and that the token for STRING$ is the two numbers 255 and 160.

To discover the token for each Basic statement and command several possible approaches are possible. You could replace the program lines below 1000 in *listing 1* with lots of Basic and then use the rest of the program to interrogate it, exactly as we have done above.

Alternatively we could approach the problem from the opposite direction. Notice that location 7701 contains '160', the token for CLS. Type into the Dragon the instruction POKE 7701,161. This will replace the '160' at location 7701, with '161'. Now type LIST-100. You will see that line 20 now reads MOTOR and deduce that '161' is the token for MOTOR. Further tokens can be discovered by experimentation.

A more sophisticated approach depends upon the observation that when we type LIST the Dragon responds by displaying the actual Basic words. These words must therefore be stored in the interpreter somewhere. They actually reside in two groups. The first group occupies locations 32819 to 33107 and the second group occupies locations 33226 to 33359.

Amend line 1070 of *listing 1* as follows:
1070 FOR I=32819 TO 33107
Now RUN the program from line 1050. The following output should be obtained:

MEM	*DEC*	*HEX*	*CHR*
32819	70	46	F
32820	79	4F	O
32821	210	D2	
32822	71	47	G
32823	207	CF	
32824	82	52	R
32825	69	45	E
32826	205	CD	
32827	167	A7	
32828	69	45	E
32829	76	4C	L
32830	83	53	S
32831	197	C5	

Although the words apper to be incomplete it is clear what they are. FOR, GO, REM, and ELSE, all with their last letter missing.

Augmenting

In fact it is not so much a case of the last letter being missing as it's being augmented. In each case the ASCII code of the last letter has been increased by 128. As an example, the ASCII code for the 'R' in FOR is 82. If we add on 128 we get 210 which is the value stored in the appropriate location 32821.

If you are a little puzzled by location 32827 then you should note that 167−128=39 which is the ASCII code for " ' ", which in turn is a shorthand form of REM.

Now this is all very fascinating (at least I hope that you find it so), but how does it help us with tokens? Well the tokens follow the same order as the Basic words, so that having discovered by one of the first two methods that the token for FOR is 128, the calculation of other tokens follows.

In order to investigate the way in which the DRAGON stores variables we need the assistance of another program (*Listing 2*).

Since we shall be amending *listing 2* it is suggested that you save the program on cassette as soon as you have typed it in.

You will quickly observe that despite its length, all the program does at present is assign values to three variables, print their memory locations, and print the contents of those locations. When you run the program, the memory locations may differ slightly to those given here, depending on whether the program has been typed in precisely as given. This is unimportant.

We assign the value "LIST" to A$ and the value "ING" to B$. The numeric variable 'A' is given the value '123'. When I ran the program I was given the following message:
'A$' IS STORED AT 8679
'B$' IS STORED AT 8686
'C$' IS STORED AT 8693
The program next displays th locations relevant to 'A$'.

The listing of these locations is given below:

MEM	*DEC*	*HEX*	*CHR*
8679	65	41	A
8680	128	80	
8681	4	4	
8682	0	0	
8683	30	1E	
8684	96	60	
8685	0	0	

Locations 8679/8680 record the fact that the variable that follows is labelled A$. '65' is the ASCII code for 'A' and '128' is a token for '$'. Had a two-character name been chosen (eg AC$), then the code for 'C', 67, would have been added to the 128 and the result 195 stored in location 8680.

Location 8681 records the number of characters in the variable. Since the variable currently contains the word 'LIST' which is 4 characters long, location 8681 contains 4.

Locations 8683/8684 store the address '7776' (30*256+96 — Remember?). This is the address at which the variable is ▶

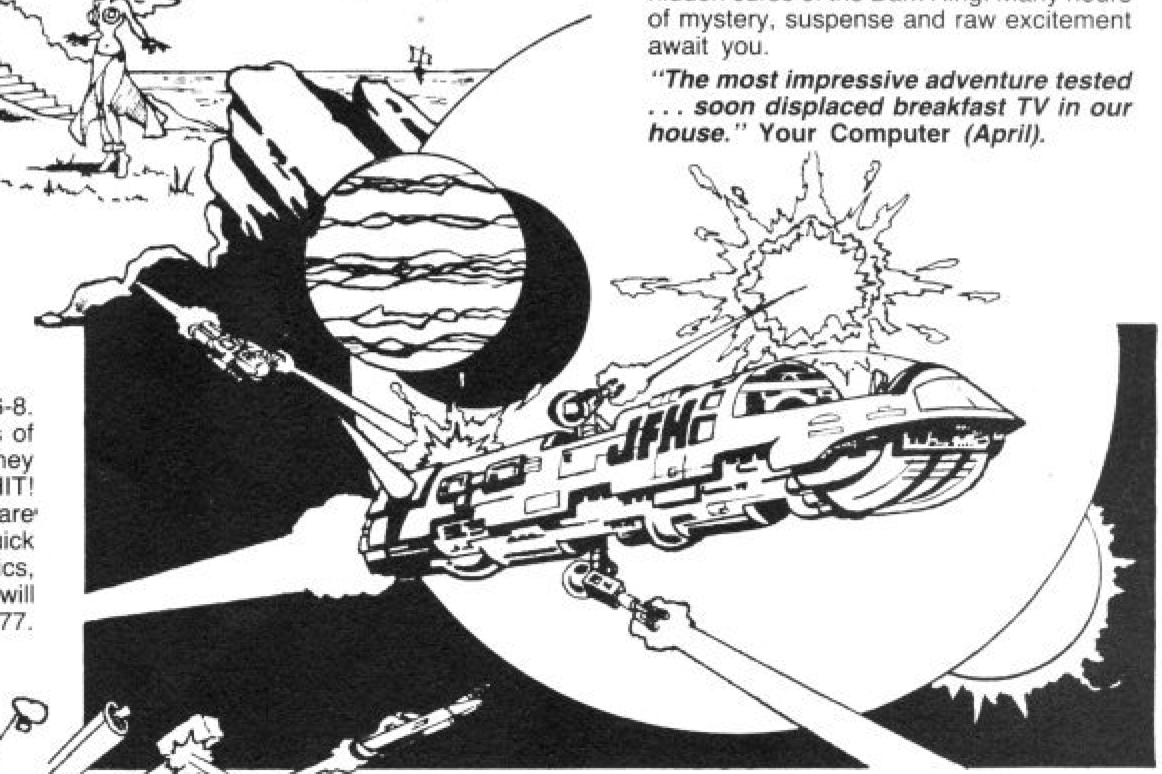
DRAGON 32

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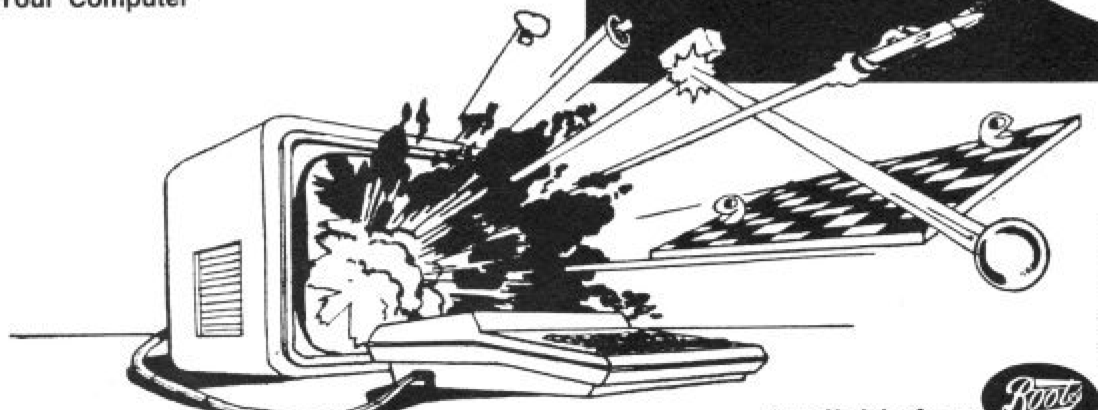
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Listing 2 – amended in text to give a third listing

```
10 REM LISTING 2
20 CLS
30 PRINT @36,STRING$(24,128)
40 PRINT @74,"LISTING 3"
50 PRINT @100,STRING$(24,128)
60 A$="LIST"
70 B$="ING"
80 A=123
90 PRINT @160,STRING$(32,156)
100 PRINT @225," 'A$' IS STORED AT ";VARPTR(A$)-2
110 PRINT @257," 'B$' IS STORED AT ";VARPTR(B$)-2
120 PRINT @289," 'A ' IS STORED AT ";VARPTR(A)-2
130 GOSUB 480
140 CLS
150 PRINT @32," THE FIRST LISTING SHOWS THE "
160 PRINT @64," LOCATIONS USED BY 'A$' "
170 GOSUB 480
180 CLS
190 P=VARPTR(A$)-2:Q=VARPTR(A$)+4
200 GOSUB 360
210 CLS
220 PRINT @32," THE NEXT LISTING SHOWS THE "
230 PRINT @64," LOCATIONS USED BY 'B$' "
240 GOSUB 480
250 CLS
260 P=VARPTR(B$)-2:Q=VARPTR(B$)+4
270 GOSUB 360
280 CLS
290 PRINT @32," THE NEXT LISTING SHOWS THE "
300 PRINT @64," LOCATIONS USED BY 'A' "
310 GOSUB 480
320 CLS
330 P=VARPTR(A)-2:Q=VARPTR(A)+4
340 GOSUB 360
350 STOP
360 GOSUB 450
370 J=1
380 FOR I=P TO Q
390 IF J/13<>INT(J/13) THEN 410
400 IF INKEY$=""THEN 400 ELSE GOSUB 450
410 PRINTUSING" £££££   £££      %%      %% ";I,PEEK(I),HEX$(PEEK(I)),CHR$(PEEK(I))
420 J=J+1
430 NEXT I
440 GOSUB 480:RETURN
450 CLS
460 PRINT"  MEM      DEC      HEX    CHR"
470 RETURN
480 PRINT @448,"!!PRESS ANY KEY TO CONTINUE!!"
490 IF INKEY$=""THEN 490
500 RETURN
```

◄ stored. In this case, as the variable has not been modified during program execution the address is the location where the variable is defined in the program. Clearly, if the variable has been modified in some way an alternative store would be required.

The program now lists the locations used by B$ and you should have no difficulty interpreting the codes displayed.

The program next displays the locations used by the numeric variable 'A'. Again the locations are reproduced below and although you may have slightly different addresses, the codes should be the same:

MEM	*DEC*	*HEX*	*CHR*
8693	65	41	A
8694	0	0	
8695	135	87	
8696	118	76	
8697	0	0	
8698	0	0	
8699	0	0	

Locations 8693/8694 store the name of the variable. If the variable had been called 'AB' then location 8694 would have contained the code '66', the ASCII code for 'B'.

Locations 8695 to 8699 actually record the value that is stored in the variable. Five bytes are provided for this purpose and this is sufficient to provide 9-digit precision and, using scientific notation, store numbers in the range 1.7×10^{-38} to 1.7×10^{38}. The way in which numbers are stored is rather complex and I shall restrict myself to positive integers for an example. In the present case 'A' has been assigned the value '123'. Now, watch closely.

Step 1: $123 = 2^6 + 59$. The highest power of 2 less than our variable is added to a base of 129. Since $6 + 129 = 135$ the first part of the number is stored as '135' — in this case in location 8695.

Step 2: Calculate $256/(2^{n+2} - 2^{n+1})$ where n is the highest power found in step 1. In our case the calculation is:
$256/(2^8 - 2^7) = 2$

Step 3: Multiply the number derived in step 2 by the remainder derived in step 1, ie $2 \times 59 = 118$. This is the second part of our number and is stored in location 8696. The remaining three locations that are allocated to the variable are not required in this case.

We shall now return to the question of what happens if a string variable is modified during the program. Amend *listing 2*:

```
350   GOTO 1000
1000  A$=A$+B$
1010  CLS
1020  PRINT" THE FOLLOWING IS
      A REVISED "
1030  PRINT" LIST OF 'A$' "
1040  P=VARPTR(A$)-2:Q=
      VARPTR(A$)+4
1050  GOSUB 480
1060  GOSUB 360
1070  STOP
```

When you run the program this time the locations of the variables will have changed since the program is now longer and is taking-up more space. In my case A$ is now stored at locations commencing 8816. The program concatenates A$ and B$ and A$ thus contains the word 'LISTING'. This is the revised listing of A$:

MEM	*DEC*	*HEX*	*CHR*
8816	65	41	A
8817	128	80	
8818	7	7	
8819	0	0	
8820	127	7F	
8821	195	C3	
8822	0	0	

Notice that location 8818 is now '7' indicating that the length of A$ is now seven characters. The address pointed to by locations 8820 and 8821 is given by our usual formula: 127∗256+195=32707. The reader is invited to amend *listing 2* to list the locations commencing at that address and satisfy himself that the word 'LISTING' is indeed stored there.■

Speeding up on double the memory

What makes POKEs work? And can the Dragon go any faster? ***George Saint*** *provides the answers.*

BY NOW, EVERYONE knows that if you POKE &HFFDF, with any number, your Dragon goes into overdrive and runs at double speed (in most cases). Why this occurs, though, is little understood. This article looks into the whys and wherefores of this handy facility, and also offers a solution to those unlucky people for whom the speed-up does not work.

First, we had better examine the Synchronous Address Multiplexer (SAM) chip in detail, which is the heart and soul of the Dragon, in order to understand what is going on. The SAM chip is a wonderful piece of engineering by Motorola. It has been specially designed to mate with the 6809E Central Processing Unit (CPU), the 6847 Video Display Generator, and the 6821 Peripheral Interface Adapter (known as PIA).

The SAM chip looks after the memory management (up to 96K!), provides the timing signals for the entire system, and organises the display timing of the TV display (there are no flashes on the Dragon TV display when the CPU is working, unlike the TRS80 or Video Genie).

Mapping

If you look at the memory map of the Dragon computer, you will see that particular attention has been paid to the top 255 bytes. A lot appears to be happening in this area of memory where the SAM chip is mapped between $FFC0 and $FFDF. There are in fact 16 options which can be selected, and to set any bit you write (ie POKE) to the unique odd address of the option.

For the double speed poke (address dependent), you POKE any value into the $FFD7 memory location, which sets the bit. The computer will now most probably work at the new higher speed. To change back to normal, or clear any bit, you write to the even address, so that a POKE to $FFD6 slows the compuer back down again.

The area from $FFD6 to $FFD9 is labelled MPU rate on the memory map, and the double speed POKE is not the fastest speed obtainable! For normal operation of the Dragon, the R0 and R1 bits are cleared by the Extended Basic ROM from initial cold start. There are critical timing loops used when loading and saving to tapes, and it would cause a great deal of frustration if these were messed up every time you switched on the beast. The Dragon is now running at a clock speed of approximately .89MHz (14.31818/16 or 14.218/16). When R0 is set, the address dependent timing mode is set, and the normal timing of .89MHz is automatically chosen for addressing between 0 and $7FFF and addresses $FF00 to $FF1F. For all other addresses, a timing frequency of 14.31818/8 is selected. This therefore gives a clock value of 1.78MHz and hence a 'double speed'. (This is the area of the Basic interpreter, so the Basic runs 'twice' as fast).

Number-crunching

If you have some heavy number crunching or vast calculations to perform, and do not have to worry about losing your display, then a POKE to $FFD9 in your program at the start of the calculations followed by a POKE to $FFD8 will make your Dragon go into superdrive. The entire memory of your machine will operate at the 1.78MHz speed, and you can say goodbye to using your keyboard and anything else while this is in operation. (The time that is normally used for the VDG/REFRESH is in fact stolen in the fast mode and used for the MPU.)

In these higher speeds, you cannot load or save cassettes satisfactorily, and this point *must always be remembered.* If you recall, I said earlier in this article that the double speek poke operation was address dependent, and the area $FF00 to $FF1F operated at the normal speed. This area is shown on the memory map as I/O0, and is in fact the keyboard interface. The keyboard therefore will work normally since it is not affected by the higher speed operation.

On the other hand, however, the area from $FF20 to $FF3F (I/O1) comes under the double speed operation, and this is the cassette interface. Any tapes saved under the high speed mode will sound much higher in pitch due to the change in timing, and will not load, so be *careful* when saving programs which use this method to speed matters up.

For those unlucky people who cannot get their machines to run faster, there is a cure. The main problem is that Motorola is very conservative with the specifications of its chips, and in fact the CPU chip used inside the Dragon is the 6809E rated at 1MHz.

Due to the high standard set by the manufacturer, a good number of these chips will work quite satisfactorily at 1.78MHz, although it is not recommended. Two other 6809 chips are produced: the 68A09E (1.5MHz) and the 68B09E (2MHz). These other chips are constructed to much higher specifications (and cost more money!) in order to achieve the higher clock speeds. A simple remedy is therefore to change your 6809E chip to the higher rated 68B09E to give access to the faster rate (although remember that opening the computer voids the guarantee). It is also interesting to note that there are also three comparable 6821 PIA chips which run at the corresponding speeds although there is no need to change these.

Heartburn

Sometimes, people are tempted to speed up their machines by changing the master crystal oscillator. This is not to be recommended as it will give your Dragon a bad case of heartburn! As I said before, the SAM chip is a very clever piece of circuitry, and one of its functions is to divide the master crystal frequency by four to produce the 3.58MHz subcarrier frequency required by the VDG. Any change to the master crystal oscillator will change this frequency, and muck up your video display. So don't be tempted.

A definite procedure must be followed when changing between any two of the three rate modes, and it should always be kept in mind that it is necessary to follow this to ensure that the MPU timing specifications are met. You can go from slow to the address dependent double speed, and then up to superdrive, or from slow straight to superdrive. But when losing speed you cannot go directly from superdrive to slow, you must go via the address dependent mode.

Some Dragons have been supplied with 64K RAM, and double speed pokes can also work on these if they are modified. During the Dragon 32's brief life, Dragon Data has made at least five changes to its circuit board.

The early Dragon machines had a piggyback circuit board with 4116 RAMs (all 32K). Modifications were made, and lo and behold, Dragons then appeared with 8 RAM chips offering 32K. These chips were in fact half-good 64K RAM chips, and some of these 64K systems will run double speed pokes satisfactorily with only a few slight hardware changes. In other cases, it is necessary to change the faulty chips for good ones to get up to the magic 64K (less 255 bytes). Unfortunately, it appears that Dragon Data is now only producing boards with 4116 RAMs and 32K.

To find out if you have 64K chips installed:

POKE&HFFDB,0.

If your machine freezes, then you have 64K RAMs onboard. ■

OPEN FILE FOR DRAGON USERS

Send us your Dragon programs, beginning with a general description and then explaining how the program is constructed. Take care that the listings are all bug-free, enclosing a printout if possible. We pay £6 for each bug-free program published, double for the program of the month. If you have any problems with the listings, please send your queries to the appropriate author, *Dragon User*, Hobhouse Court, 19 Whitcomb Street, London WC2 7HF.

Converting

From A J Pimperton who comes from Coventry

THIS PROGRAM PROVIDES a table of hex and binary numbers which is not found in the Dragon manual. The output can be passed to either screen or the printer. The binary number is made up using a string eight characters long, each of which is a 1 or a 0. The string is then concatenated in line 220.

```
10 '      CONVERSION TABLE
20 '      (C) A.J.PimPerton (1983)
40 CLS
50 PRINT@200,"OUTPUT TO"
60 PRINT@228,"PRINTER(P) OR SCREEN(S)
70 INPUT A$
80 IF A$="P" THEN P=-2:GOTO 100
90 IF A$="S" THEN P=0 ELSE 40
100 PRINT#P,"DECIMAL";TAB(10);"HEX";TAB(20);"BINARY"
110 PRINT#P,STRING$(28,"-")
120 FOR I=0 TO 255
130 N=I
140 IF N/128>=1 THEN N=N-128:N1$="1" ELSE N1$="0"
150 IF N/64>=1 THEN N=N-64:N2$="1" ELSE N2$="0"
160 IF N/32>=1 THEN N=N-32:N3$="1" ELSE N3$="0"
170 IF N/16>=1 THEN N=N-16:N4$="1" ELSE N4$="0"
180 IF N/8>=1 THEN N=N-8:N5$="1" ELSE N5$="0"
190 IF N/4>=1 THEN N=N-4:N6$="1" ELSE N6$="0"
200 IF N/2>=1 THEN N=N-2:N7$="1" ELSE N7$="0"
210 IF N/1>=1 THEN N8$="1" ELSE N8$="0"
220 N$=N1$+N2$+N3$+N4$+N5$+N6$+N7$+N8$
230 PRINT#P,I;TAB(10);HEX$(I);TAB(20);N$
240 NEXT
```

Nail and thread

From George Smith in Barnsley

THE LINE COMMAND used in high resolution graphs (PMODE4) can be used to produce 'Nail and Thread' designs, such as this simple drawing of a sailing ship.

Program notes

Lines	
10	Sets high resolution.
20	Sets start co-ordinates of (A,B) and (X,Y).
30	Draws line between first start position of (A,B) and (X,Y).
40-50	Increases B and X positions and re-draws until B reaches 120 (this draws the rear sail).
100	Resets start co-ordinates of (A,B) & (X,Y).
110-130	Draws front sail as detailed in lines 30-50 until value B reaches 120.
200-230	Draws the hull of the ship with an additional increment on A co-ordinate to produce the slope of the prow.
300	Draws the mast.
310-320	Draws a circle and paints it in to represent the sun.

```
  1 REM ***************************
  5 REM **** NAIL AND THREAD *****
  6 REM ****     BY G.SMITH   *****
  7 REM ***************************
 10 PMODE4,1:SCREEN1,1:PCLS
 20 A=120:B=12:X=130:Y=120
 30 LINE(A,B)-(X,Y),PSET
 40 B=B+6:X=X+4
 50 IF B)=120 THEN 100 ELSE 30
100 A=120:B=12:X=110:Y=120
110 LINE(A,B)-(X,Y),PSET
120 B=B+6:X=X-3
130 IF B)=120 THEN 200 ELSE 110
200 A=46:B=124:X=72:Y=136
210 LINE(A,B)-(X,Y),PSET
220 A=A+2:B=B+1:X=X+12
230 IF B)=136 THEN 300 ELSE 210
300 LINE(120,12)-(120,128),PSET
310 CIRCLE(220,20),18
320 PAINT(220,20):GOTO 320
```

Joy of music

From D A Wright in Crawley

THIS PROGRAM USES the joystick input of the Dragon 32 to play musical notes whilst giving a visual display of the frequency. The JOYSTK inputs are used as follows: the fore and aft movement is coarse control and the side to side movement gives fine control.

Line 20 switches the machine to dual mode clock. This doubles the effective clock speed when assessing the Basic and higher areas of memory. Ram is, however, still accessed at 0.9Mhz as normal. On most programs this one line reduces the execution time to about 70 per cent of the single speed version. It is important to switch back to single-mode prior to using the tape I/O as the I/O baud rate is also doubled. This can either be done by pressing the Reset button beside the tape lead input or by inputing Poke &HFFD6,0.

```
1Ø REM D.A.WRIGHT JAN83
2Ø POKE &HFFD7,Ø
3Ø PMODE4:SCREEN1,1:PCLS
4Ø LINE(Ø,Ø)-(255,Ø),PSET
5Ø FOR J=1 TO 255 STEP 1Ø:LINE(J
,Ø)-(J,4),PSET:NEXT J
6Ø J=Ø
7Ø A=JOYSTK(Ø):B=JOYSTK(1)
8Ø Z=A+B*4:IF Z 1 OR Z 255 THEN 7Ø
9Ø J=J+1
1ØØ PSET(Z,J,1)
11Ø SOUND Z,1
12Ø IF J=191 THEN 3Ø ELSE 7Ø
```

Colour mix

From D J Sill in Rochester

THIS PROGRAM IS designed to allow mixing of colours on the high-resolution screen of the Dragon 32. There are 12 more colours to be obtained in this way.

RUN the program and you will be shown the Dragon's basic colour selection. From this you are asked to choose a colour for mixing. You will then be shown the mixes available with the colour you have chosen, in both the available colour sets.

Whilst waiting for the colours to be mixed, you are shown the available colours, both in high-resolution and on the text screen. You may then make your selection of colours to be mixed, and the resulting new colour will be instantly displayed. Full instructions are in the program.

Program notes

Lines	
40-70	Initialisation.
80-300	Colour mixing.
310-820	Text screen presentation.
830-900	Format titles.

```
10 GOTO30
20 CSAVE"COLCRTOM":SOUND1,1:END
30 '
40 CLS0
50 PCLEAR8:FORI=1TO7 STEP2
60 PMODE1,I:PCLS:NEXTI
70 GOTO310
80 'PAGE 1
90 PMODE1,1:PCLSA
100 COLORA+1,A:LINE(128,0)-(255,63),PSET,BF
110 COLORA+2,A:LINE(128,64)-(255,127),PSET,BF
120 COLORA+3,A:LINE(128,128)-(255,191),PSET,BF
130 SCREEN1,0
140 'PAGE 2 - A+(A+1)
150 PMODE1,3:PCLSA:COLORA+1,A
160 GOSUB260
170 SCREEN0,1
180 'PAGE3 -- A+(A+2)
190 PMODE1,5:PCLSA:COLORA+2,A
200 GOSUB260
210 PMODE1,1:SCREEN1,1
220 'PAGE4 - A+(A+3)
230 PMODE1,7:PCLSA:COLORA+3,A
240 GOSUB260
250 GOTO640
260 FORI=0TO255STEP4:FORJ=0TO191STEP4
270 PSET(I,J):NEXTJ,I
280 FORI=2TO255STEP4:FORJ=2TO191STEP4
290 PSET(I,J):NEXTJ,I
300 RETURN
310 'MAIN
320 CLS0:F$="COLOUR COMBINATIONS":P1=1:GOSUB830
330 PRINT@32*5+3,STRING$(3,CHR$(153))+"SET 1"+STRING$(3,CHR$(153));
340 PRINT@32*5+19,STRING$(3,CHR$(217))+"SET 2"+STRING$(3,CHR$(217));
350 PRINT@32*7+3,STRING$(3,CHR$(143))+"=1";
360 PRINT@32*9+3,STRING$(3,CHR$(159))+"=2";
370 PRINT@32*11+3,STRING$(3,CHR$(175))+"=3";
380 PRINT@32*13+3,STRING$(3,CHR$(191))+"=4";
390 PRINT@32*7+19,STRING$(3,CHR$(207))+"=1";
400 PRINT@32*9+19,STRING$(3,CHR$(223))+"=2";
410 PRINT@32*11+19,STRING$(3,CHR$(239))+"=3";
420 PRINT@32*13+19,STRING$(3,CHR$(255))+"=4";
430 PRINT@32*15+2,"WHICH COLOUR DO YOU REQUIRE?";
440 A$=INKEY$:IFA$=""THEN440
450 A=VAL(A$):IFA<1 OR A>4 THEN310
460 CLS0:F$="COLOURS AVAILABLE":P1=1:GOSUB830
470 F$="SET 1":P1=4:GOSUB830
480 PRINT@32*7,STRING$(32,CHR$(134+(A-1)*16));
490 B=A+1:IFB>4 THENB=B-4
500 PRINT@32*8+2,STRING$(8,CHR$(134+(B-1)*16));
510 B=A+2:IFB>4 THENB=B-4
520 PRINT@32*8+12,STRING$(8,CHR$(134+(B-1)*16));
530 B=A+3:IFB>4 THENB=B-4
540 PRINT@32*8+22,STRING$(8,CHR$(134+(B-1)*16));
550 F$="SET 2":P1=9:GOSUB830
560 B=A+4:PRINT@32*12,STRING$(32,CHR$(134+(B-1)*16));
570 B=A+4+1:IFB>8 THENB=B-4
580 PRINT@32*13+2,STRING$(8,CHR$(134+(B-1)*16));
590 B=A+4+2:IFB>8 THENB=B-4
600 PRINT@32*13+12,STRING$(8,CHR$(134+(B-1)*16));
610 B=A+4+3:IFB>8 THENB=B-4
622 PRINT@32*13+22,STRING$(8,CHR$(134+(B-1)*16));
630 PRINT@15*32+1,"PLEASE WAIT WHILE COLOURS MIX";:GOTO80
640 SOUND200,2:PRINT@14*32,STRING$(63,CHR$(128));
650 PRINT@14*32,"ENTER SET NO. REQUIRED";:SCREEN0,1
660 Q$=INKEY$:IFQ$=""THEN660
670 Q=VAL(Q$):IFQ<1 OR Q>2 THEN640
680 PRINT@14*32,STRING$(32,CHR$(128));
690 PRINT@14*32,"ENTER COLOUR TO BE MIXED: 1/2/3 ";
700 PRINT@15*32,"PRESS SPACEBAR TO RETURN";:SCREEN0,1
710 Z$=INKEY$:IFZ$=""THEN710
720 Z=VAL(Z$):IFZ<1 OR Z>3 THEN690
730 PRINT@14*32,STRING$(63,CHR$(128));
740 PMODE1,2*Z+1:SCREEN1,Q-1
750 R$=INKEY$:IFR$=""THEN750
760 IFR$<>" "THEN750
770 PRINT@14*32,"PRESS 'ENTER' FOR ANOTHER MIX";
780 PRINT@15*32,"PRESS 'X' FOR ANOTHER COLOUR";:SCREEN0,1
790 R$=INKEY$:IFR$=""THEN790
800 IFR$=CHR$(13)THEN640
810 IFR$="X"THEN310
820 GOTO790
830 '
840 'FORMAT TITLES
850 '
860 P2=14-INT(LEN(F$)/2)
870 PRINT@32*P1+P2,STRING$(LEN(F$)+2,150);
880 PRINT@32*(P1+1)+P2,CHR$(150)+F$+CHR$(150);
890 PRINT@32*(P1+2)+P2,STRING$(LEN(F$)+2,150);
900 RETURN
```

Brain teaser

From P Hill in Stevenage

THIS GAME IS on the lines of Mastermind. The computer asks for a number of letters (up to 26) and the player must find the correct sequence, if he/she cannot then pressing 6 will show the correct answer to the game.

Program notes

Lines	
80-150	Pick the number of letters.
160-220	Sort the letters and place them in E$.
230-390	Ask for the answer, check which letters are wrong and which right, and count them.
400-420	Print the answer.
430-460	Play a tune if you find the correct sequence.

```
10 '      ******************
15 ' ===    BRAIN TEASER    ===
20 ' ===     BY P.HILL      ===
30 '      ******************
40 CLS
```

Continued on page 42

```
50 PRINT
60 INPUT" HOW MANY LETTERS";M
70 CLS
80 PRINT@167,"computer thinking"
90 FOR NN=1 TO 600:NEXT
100 REM PICK A LETTER
110 FOR N=1 TO M
120 R=RND(26)+64
130 A$=CHR$(R)
140 F=F+1
150 IF F<2 THEN 210
160 REM SORT LETTERS
170 FOR L=1 TO M
180 FOR Q=1 TO L
190 IF MID$(E$,L,1)=LEFT$(A$,Q) THEN GOTO 120
200 NEXT Q,L
210 E$=E$+A$
220 NEXT N
230 SOUND100,3:CLS
240 PRINT@37,"b r a i n  t e a s e r"
250 PRINT@264,"GUESS";M;"LETTERS"
260 PRINT@429,"";:INPUT B$
270 REM chicken!!
280 IF B$=CHR$(54) THEN 400
290 FOR N=1 TO M
300 REM ANY LETTERS INCORRECT?
310 IF MID$(B$,N,1)<>MID$(E$,N,1) THEN T=T+1
320 REM ANY LETTERS CORRECT?
330 IF MID$(B$,N,1)=MID$(E$,N,1) THEN S=S+1
340 REM ARE ALL LETTERS CORRECT
350 IF B$=E$ THEN 440
360 NEXT N
370 PRINT@166, T;"WRONG",S;"RIGHT"
380 T=0:S=0
390 GOTO 250
400 REM THE ANSWER.
410 PRINT@428,"- ";E$;" -"
420 SOUND10,6:GOTO 470
430 REM PLAY TUNE.
440 PLAY"L100O4ABCDEFG"
450 T=T+1:IF T<>M THEN 430
460 PLAY"L200O5FAFAFAF"
470 END
```

Dice game

From Brian Cadge in Birmingham

THE PROGRAM STARTS with a bright title page welcoming you to the game. The DATA statements are print positions for the word DICE to be displayed. The game uses the GET and PUT commands to display the dice faces; arrays D1 to D6 hold the respective dice picture. Array A$(0) to A$(9) hold the DRAW command strings for the numbers 1-9 used for the game and to display the score.

The game uses PMODE 1 graphics with the first colour set (green/yellow/blue/red). The blue number displayed on the left is the number of rolls of the dice left in the game. The dice are rolled a random number of times before stopping and displaying the score, pressing the number (or one of the numbers) you wish to remove will erase that number (or numbers) and pressing ENTER will pass — illegal entries are ignored.

As variables cannot be used with the PUT command, a series of IF — THENs are used to display the correct dice face. Your score is also continually displayed at the top left of the screen. At the end of a game GAME OVER appears — pressing any key will begin a new game. My highest score is 661, can anyone beat that?

Listing opposite

```
10 CLS:PRINT@75,"DICE GAME":PRINT:PRINT"NEED INSTRUCTIONS (Y/N)"
20 I$=INKEY$
30 IF I$="Y" THEN 780
40 IF I$<>"N" THEN 20
50 CLS0
60 FOR L=1 TO 3:PRINT@L*32+5,"";:FOR C=1 TO 22:READ A:PRINTCHR$(A+16);:NEXT C,L
70 PRINT@192,STRING$(64,143);STRING$(64,143+64);STRING$(64,143+32);STRING$(64,14
3+16);STRING$(63,143+80);:POKE 1535,143+80
80 FOR D=1 TO 76:READA:PRINT@A-1,CHR$(128);:NEXT
90 PRINT@133,"Press"+CHR$(128)+"any"+CHR$(128)+"key"+CHR$(128)+"to"+CHR$(128)+"s
tart";:SCREEN0,1
100 IF INKEY$="" THEN 100
110 MOTOROFF:AUDIOOFF:SOUND1,2:SOUND5,2:SOUND10,2
120 DATA 133,128,133,133,140,133,128,133,140,133,141,133,141,141,133,140,128,128
,141,136,142,138
130 DATA 133,133,133,133,136,133,128,133,128,133,133,133,132,133,133,136,128,128
,133,128,138,138
140 DATA 132,140,140,132,140,132,140,132,140,132,140,132,128,132,132,140,128,128
,132,128,140,136
150 DATA 228,229,230,263,296,328,360,392,423,454,453,452,420,388,356,324,292,260
160 DATA 234,235,236,237,238,268,300,332,364,396,428,460,459,458,461,462
170 DATA 240,241,242,243,276,272,304,336,368,400,432,464,465,466,467,436
180 DATA 246,247,248,249,250,278,310,342,374,406,438,470,471,472,473,474,343,344
,345
190 DATA 253,285,317,349,381,413,477
200 DIM D1(0,8),D2(0,8),D3(0,8),D4(0,8),D5(0,8),D6(0,8)
210 PMODE1,1:COLOR2,3:PCLS
220 DRAW"BM4,4R1BM16,4R1BM4,16R1BM16,16R1":GET(0,0)-(21,21),D4,G:DRAW"BM10,10R1"
:GET(0,0)-(21,21),D5,G:PCLS
230 DRAW"BM10,10R1":GET(0,0)-(21,21),D1,G:DRAW"BM4,4R1BM16,16R1":GET(0,0)-(21,21
),D3,G:DRAW"C3BM10,10R1C2":GET(0,0)-(21,21),D2,G
240 DRAW"BM16,4R1BM16,10R1BM4,10R1BM4,16R1":GET(0,0)-(21,21),D6,G
250 COLOR2,1:PCLS
260 A$(0)="R15D20L15U20":A$(1)="BR15D20":A$(2)="R15D10L15D10R15":A$(3)="R15D10NL
15D10L15":A$(4)="D10R15U10D20":A$(5)="NR15D10R15D10L15":A$(6)="NR15D20R15U10L15"
:A$(7)="R15D20":A$(8)="XA$(0);D10R15":A$(9)="XA$(5);BU10BR15U10"
270 SC=0:DRAW"C4BM180,10L10D6R10D6L10BR17NR10U12R10BR5R10D12L10U12BR17R10D6L10NU
6ND6R3F7BR5NR10U6NR8U6R10"
280 SCREEN1,0:CLS
290 FORI=1 TO 9:N(I)=I:NEXTI:G0=9
300 DRAW"C2"
310 FORI=0 TO 8:J=I-INT(I/3)*3+1:DRAW"BM"+STR$(INT(J*30)+16)+","+STR$(INT(I/3)*4
0+20)+A$(I+1):NEXTI
320 COLOR3:LINE(176,90)-(197,111),PSET,BF:LINE(216,90)-(237,111),PSET,BF
330 'game starts here
340 LINE(175,30)-(240,60),PRESET,BF:S1=INT(SC/100):S2=INT((SC-S1*100)/10):S3=SC-
S1*100-S2*10:DRAW"C2BM175,30XA$(S1);BM199,30XA$(S2);BM223,30XA$(S3);"
350 GG=G0:IF G0<0 THEN G0=0
360 LINE(6,60)-(20,85),PRESET,BF:DRAW"C3BM6,60XA$(G0);"
370 T0=0:FORI=1TO9:T0=T0+N(I):NEXT
380 IF T0=0 THEN PLAY"T60V31O5EFGANEFGABEFGAB":GOTO290
390 IF GG<0 THEN 740
400 IF I$=CHR$(13) THEN 420
410 I$=INKEY$:IF I$="" THEN 410
420 IF I$<>CHR$(13) THEN 410
430 PLAY"T60O5V31EFGAB"
440 FORI=1 TO 8+RND(5)
450 T1=RND(6):T2=RND(6)
460 T3=T1:X=176:Y=90:GOSUB490:T3=T2:X=216:GOSUB490
470 NEXTI
480 GOTO560
490 IF T3=1 THEN PUT(X,Y)-(X+21,Y+21),D1,PSET
500 IF T3=2 THEN PUT(X,Y)-(X+21,Y+21),D2,PSET
510 IF T3=3 THEN PUT(X,Y)-(X+21,Y+21),D3,PSET
520 IF T3=4 THEN PUT(X,Y)-(X+21,Y+21),D4,PSET
530 IF T3=5 THEN PUT(X,Y)-(X+21,Y+21),D5,PSET
540 IF T3=6 THEN PUT(X,Y)-(X+21,Y+21),D6,PSET
550 RETURN
560 X=176:FORD=1TO200:NEXTD:T1=RND(6):T3=T1:GOSUB490:SOUND240,1:FORD=1TO200:NEXT
D:X=216:T2=RND(6):T3=T2:GOSUB490:SOUND240,1
570 T3=T1+T2
580 I$=INKEY$:IF I$="" THEN 580
590 IF I$=CHR$(13) THEN 710
```

Continued on page 45

```
600 TT=VAL(I$):IF TT<1 OR TT>9 THEN 580
610 IF N(TT)=0 THEN 580
620 IF TT=T3 THEN 690
630 FORI=1 TO 9:IF I=TT THEN 650
640 IF N(I)+TT=T3 THEN 660
650 NEXTI:GOTO580
660 SOUND240,1
670 N(I)=0:N(TT)=0:I1=I-1:GOSUB680:I1=TT-1:GOSUB680:SC=SC+TT*I:GOTO710
680 J=I1-INT(I1/3)*3+1:J=J*30+16:J1=INT(I1/3)*40+20:LINE(J,J1)-(J+15,J1+20),PRES
ET,BF:RETURN
690 SOUND240,1:I1=TT-1:GOSUB680:SC=SC+TT
700 N(TT)=0
710 G0=G0-1:IF T1=T2 THEN G0=G0+2
720 IF G0>9 THEN G0=9
730 GOTO340
740 PLAY"V31T6005EFGABEFGABEFGAB"
750 COLOR2:LINE(0,168)-(108,184),PSET,BF:DRAW"C4BM10,170S8;L4D6R4U3NL2;BR2BD3U6R
4D3NL4D3BR2;U6R2ND3R2D6BR2;NR4U3NR2U3R4BR8;NR4D6R4NU6BR2;BU6 M+2,+6;M+2,-6;BR2;N
R4D3NR2D3R4BR2;U6R4D3L4R1F3;S4"
760 I$=INKEY$:IF I$="" THEN 760
770 GOTO250
780 'INSTRUCTIONS
790 CLS
800 PRINT"PRESS THE 'ENTER' KEY TO ROLL   THE DICE. THE OBJECT OF THE GAMEIS TO
REMOVE ALL OF THE NUMBERS FROM THE SCREEN, EITHER ONE AT ATIME IF THE SUM OF THE
 TWO DICE IS EQUAL TO THAT NUMBER, BY        PRESSING THE APPROPRIATE NUMBER"
810 PRINT"OR REMOVING TWO AT A TIME IF       THEIR SUM IS EQUAL TO THE SUM OFTHE TW
O DICE, THIS SCORES MORE  THAN REMOVING JUST ONE."
820 PRINT:PRINT"PRESS ANY KEY....":EXEC 41194
830 GOTO 50
```

Calendar

From Michael Holland in Orpington

THIS PROGRAM IS designed to give a monthly calendar on the screen of your Dragon. The program requires the month number and the year to be input before it computes the appropriate starting day. The days of the month are then printed in their correct positions using the PRINT@ command. The screen can now be scrolled backwards or forwards using the 'B' and 'F' keys or you can go back to the data input routine by pressing the 'S' key.

Although the program is self-contained, the logic could easily be converted for use in other programs such as a diary or biorhythms. Note: to end the program the 'Break' key must be pressed TWICE.

Program notes

Lines	
10-100	Define the arrays A and M$ and fill them with the number of days in each month and the names of the months respectively.
110	Fills Z$ with the underline characters for the screen heading.
120-200	Clear the screen, print the program title, then input month and year data checking that M is in the range 1-12 and Y is a 2 digit number.
210-320	Compute the start day for the current month with the result, T, being a number from 1 to 7.
330	Checks for a leap year and adjust the value of T accordingly.
340-450	Print the heading lines, then loop (400-450) to print each day in the correct colomn increasing the print position (J) by 4 until the end of the month (I).
460-500	Check the keyboard for the input of 'S' (go to program start), 'F' (scroll forward 1 month), or 'B' (scroll backwards 1 month) and jump to the appropriate program line after setting M and Y.

```
1 '               DRAGON 32 CALENDAR
2 '               ------------------
3 '               (C) M.J. HOLLAND  1983
10 CLS
20 DIM A(12)
30 FOR I=1 TO 12:READ A(I):NEXT
40 DATA 31,28,31,30,31,30,31,31,30,31,30,31
50 DIM M$(12)
60 FOR I=1 TO 12:READ M$(I):NEXT
70 DATA JANUARY,FEBRUARY,MARCH
80 DATA APRIL,MAY,JUNE,JULY
90 DATA AUGUST,SEPTEMBER,OCTOBER
100 DATA NOVEMBER,DECEMBER
110 Z$=STRING$(18,"-")
```

Continued on page 47

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```
120 CLS
130 PRINT@7,"DRAGON 32 CALENDAR"
140 PRINT@39,Z$
150 PRINT
160 INPUT " MONTH NUMBER ";M
170 IF M<1 OR M>12 THEN PRINT"  INVALID MONTH ":GOTO 160
180 PRINT
190 INPUT " YEAR          ";Y
200 IF Y>1900 THEN Y=Y-1900
210 A=INT(Y/12)
220 B=Y-A*12
230 C=INT(B/4)
240 T=A+B+C+1
250 IF M=9 OR M=12 THEN T=T+6
260 IF M=6 THEN T=T+5
270 IF M=2 OR M=3 OR M=11 THEN T=T+4
280 IF M=8 THEN T=T+3
290 IF M=5 THEN T=T+2
300 IF M=1 OR M=10 THEN T=T+1
310 IF T>14 THEN T=T-14
320 IF T>7 THEN T=T-7
330 IF Y/4=INT(Y/4) AND M=2 THEN T=T-1
340 CLS
350 PRINT@34,M$(M);" ";Y+1900
360 PRINT@98,"SUN MON TUE WED THU FRI SAT"
370 L=A(M)
380 IF Y/4=INT(Y/4) AND M=2 THEN L=29
390 J=158+(T*4)
400 FOR I=1 TO L
410 IF T>7 THEN T=1:J=J+36
420 PRINT@J,I;
430 T=T+1
440 J=J+4
450 NEXT I
460 P$=INKEY$:IF P$="" THEN 460
470 IF P$="S" THEN GOTO 120
480 IF P$="F" THEN M=M+1:IF M>12 THEN Y=Y+1:M=1
490 IF P$="B" THEN M=M-1:IF M<1 THEN Y=Y-1:M=12
500 GOTO 210
```

Demo

From Mark Attwood in Warrington

THIS PROGRAM SHOWS the extensive capabilities of the graphics on the Dragon. It uses commands like DRAW and CIRCLE. It is not very long but it shows a great deal of detail. I find it particularly funny when the slime comes along to overtake the man.

Program notes as follows:

20	Sets the mode.
30	Draws the man.
50-70	Draw the circle.
80	Clears the screen.
100	Pauses execution.
110	Draws the words.
120	Clears the screen.

```
10 REM DEMO BY MARK ATTWOOD
20 REM DRAGON DEMO
30 PMODE 3,1:PCLS:SCREEN1,1
40 DRAW"BM 115,96C8R3U1R3U1R3U1R4U3L1U2L1U3L1U2L1U1L1U1L1U1L3U1L9D1L1D1L2D1L2D2L
1D2L1D2L1D3L1D8R1D4R1D2R1D2R1D2R2D1R2D1R2D1R8U1R2U1R1U1R1U1R1U1R1U1R1U1R1U2R1U1L
1U1L1D1L3U1L2U1L2U2L2U1L1BU9BR4U1L1D1R1BU7U6BL3D6"
50 FOR B=1 TO 99
60 CIRCLE (189,96),B,6
70 NEXT B
80 PCLS
90 FOR A= 1 TO 50:NEXT A
100 DRAW"BM 24,144 S8U8R4BD4L4D4R4BR8U8R4BD4L4D4R4BR8U8D4E4G4F4"
110 PCLS
120 GOTO 100
```

If you've got a technical question or problem write to Cathy Hyde, Dragon Answers, *Dragon User*, Hobhouse Court, 19 Whitcomb Street, London WC2 7HF

Dragon Answers



Wiping tapes clean

ON THE additional information sheet of the Dragon manual is the recommendation to completely wipe a cassette tape before re-use. How is this accomplished? I am using an EG2016 cassette recorder.

G Scott,
Menai Bridge,
Gwynedd.

THE SIMPLEST way to wipe the cassete tape clean before re-use is, while connected to the Dragon, to rewind to the beginning of the tape, type in MOTOR ON and then press play and record.

Converting to Spanish

COULD YOU tell me where I could get software to convert Spanish into English.

J Connell,
Falkirk,
Stirlingshire.

I AM not aware of any software on the market at present to convert Spanish into English. Unfortunately, there seems little demand for such software — and demand is generally the main deciding factor for software houses.

Monitor conversion

CAN YOU tell me whether the video monitor port on the Dragon is compatible with a 14 inch Sony colour TV, and how can the TV be converted to operate as a monitor?

Peter Styles,
Allesley,
Coventry.

IN THEORY, it should be possible to use your Sony 14 inch television as a monitor from the Dragon's monitor socket. However, you would have to bypass video and audio circuitry within the television and this is not generally advisable unless you have a *great deal* of electronics knowledge.

Dragon Data may be able to assist on this matter should you wish to pursue it, and I suggest you contact its Customer Support Department for further details.

Automatic scrolling

COULD YOU please tell me why the program below goes diagonally across the screen after filling it with CHR$?

```
10 CLS
20 FOR I=1 TO 511:A=RND
  (112):?@I,CHR$(128+A):NEXT
```

Neil Blagden.

THE PROBLEM that you have encountered with this program arises from the automatic scroll feature on the Dragon 32, but this may be overcome by modifying your program. When you use a PRINT statement the spaces to the right of the printed characters are cleared.

Therefore you should place a semi-colon at the end of the print statement which will prevent autoscroll on the bottom line. For example:

```
10 CLS
20 FOR I=1 TO 511:A=RND
(112): PRINT@I,CHR$(128+A);:
NEXT
```

Jump up and down

I WONDER if you could help us please because I have a couple of problems with my Dragon 32, which I have only had for three months. Underneath the Dragon where the power goes in, after only 10 minutes it gets very hot. After one hour the TV picture starts to jump up and down. I think the two problems are connected.

I know that it is not the TV which causes the picture to jump because I have tried it on both the colour and the black and white TVs.

With the heating-up problem we don't have the room very warm and the computer is at the back of the room on a high table, so we don't think that is the cause of the problem.

S Bromwell,
Rochdale,
Lancs.

ALTHOUGH THE bottom of the Dragon will get fairly hot, it would appear, from the details given, that this heating is causing instability in the video circuitry.

A slight adjustment by your dealer may cure this problem or the machine may need to be returned to Dragon Data by your dealer. Therefore I suggest you contact your dealer for testing and adjustment — or replacement as necessary.

Separate programs

I WOULD like to know whether it is possible to load 'separate' programs into the Dragon 32's memory.

For your guidance please note that I have written sets of programs with a 'main' program to be loaded every time and then at least two other small programs added. So far my Dragon has refused to load all three although the combined K is within the user available RAM.

S Saliba,
San Gwann,
Malta.

IT IS possible to load separate Basic programs into the Dragon 32 without effectively performing a new statement. This method requires the modification of the Basic storage pointers so that the start of the second program lies beyond the end of the first program.

As you have renumbered the second program to load after the first, the procedure is as follows:

1) Load the first program into memory
2) Find the start of the program using
B=PEEK(25) : C=PEEK(26)
3) Note these values
4) Find the end of the program using:
A=PEEK(27)*256+PEEK(28)−2: ?A
5) Type in:
POKE25,INT(A/256):POKE26,A−(INT(A/256)*256)
6) Load your renumbered program
7) Type in:
POKE 25, b:POKE26,c:EXEC 33773
Where b=value of variable B and c=value of variable C
8) Finally, save an ASCII copy of your program using CSAVE "program name", A.

Proposal rejected

I HAVE three questions:

1. Could you explain the 6804 LEA instruction (how INX can be achieved).
2. I heard that the Dragon keyboard interrupts the processor. Is this true, and if so which line does it use?
3. Will you marry me?

Dave Rowntree,
London SE18.

1. THE 6809 LEA instruction is a Load Effective Address instruction which loads a specific register with the original value plus a number. INX can be achieved using this very easily. For example LEAX 1,X will load the X register with 1 plus the contents of the X register, thus incrementing it.
2. See article on input/output in July issue of *Dragon User* (pages 38-39).
3. I'm far too busy answering letters at present to have time to marry anyone but I shall certainly keep the offer on file should the need ever arise!

Competition Corner

Answers to Competition Corner, *Dragon User*, Hobhouse Court, 19 Whitcomb Street, London WC2 7HF.

Monkey around to win a monitor

Statacom and Portatel reward Gordon Lee's puzzle

THIS PIECE OF verse sounds familiar — at least until the end of the third line:

Two and two are four,
Four and four are eight,
Eight and eight are one-zero,
One-zero and one-zero are two zero.

It may leave a lot to be desired poetically, but nevertheless it is mathematically correct. At least it is if you are either a 16-fingered extra-terrestrial, or you are a computer using the hexadecimal system of numbering. Hexadecimal, or Hex for short, has a base of 16 as opposed to the more familiar decimal system with its base of ten.

Clearly, the use of the decimal system is so inbred that it can be difficult to imagine that there are also an infinite number of other systems of counting. The first question must be: "OK, but what use are they?" Probably until the advent of the first electronic computers, these number systems were mainly of academic interest, although the binary system can be a useful tool in solving certain problems in recreational mathematics.

In the early years of this century the American puzzler Sam Loyd published a puzzle based on what he called the octamal system. His attention had been taken by a certain species of monkey which possessed only four digits on each hand. Had they been able to count, they would have used the octamal, or eight-based, system. How, wondered Loyd, would the number 1906 be written in octamal? 1906, incidentally, was the date that this puzzle appeared?

Before we consider the puzzle further, let's look at some of the general principles involved. For example, a house may be priced at £24,975. This is really the same as saying: $2 * 10^4 + 4 * 10^3 + 9 * 10^2 + 7 * 10^1 + 5 * 10^0$ (10^1 is, of course equal to 10, and 10^0 — or any other value to the power zero — is equal to 1.) In other words, we have two lots of ten thousand, four lots of a thousand, nine lots of a hundred, seven lots of ten, and five units. As we are using the decimal system, note that each place that we move to the left increases by a magnitude of ten — that is the factor is the same as the base value.

In binary we increase by a factor of two, so our house price would appear as: £ 110000110001111. The price is still the same, but, as we have only zeros and ones with which to count, we need to use 15 digits to express what in decimal requires only five.

We can go one better than this by using the hexadecimal system where the same number can be expressed as 618F. Note the introduction of the letter F. As we have 16 units in the hex system (0 to 15), we need six new digits to represent the values equivalent to 10 to 15 in decimal. The letters A to F are generally used for this purpose. So the number 618F in hex would have the decimal equivalent of: $6 * 16^3 + 1 ** 16^2 + 8 * 16^1 + F * 16^0$ (note F = 15).

To return to Sam Loyd's puzzle, you should now be able to work out how to convert 1906 into 'octamal'. The answer is 3562, but I'll leave the working to you!

It is an interesting fact that the number 121 is a perfect square in *every* number system. As well as being equal to 11^2 in our usual decimal, the figures 121 represent nine in binary, 16 in ternary (base 3), and so on. However, this does not necessarily apply to *all* numbers that are perfect squares in the decimal system. Take, for example, the number 225. **Can you find three bases, apart from base 10, in which this number would represent a perfect square? Of course, there may be an infinite number of them, but what are the smallest?**

Prize

THIS MONTH'S PRIZE comes from Statacom and Portatel who are offering the competition winner a Luxor colour monitor. This 14-inch composite video monitor can also be used as a TV — Portatel Conversions is its distributor and Statacom the sole retailer.

Rules

TO WIN THE colour monitor, you have to send in the most elegent solution to the puzzle. You must show both the answer to the competition and how to solve it with the use of a Basic program developed on your Dragon 32.

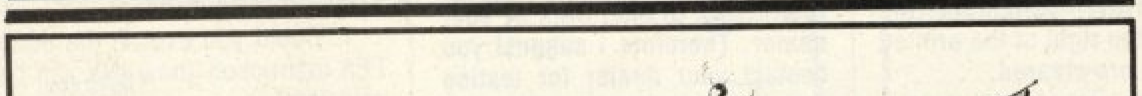
As a tie-breaker, complete the following sentence in 15 words or less:
I want to add a colour monitor to my Dragon 32 in order to ....
....

Your entry must arrive at *Dragon User* by the last working day in August 1983. The name of the winner, and the solution to the puzzle, will be printed in the October issue of *Dragon User*. You may only enter the competition once. Entries will not be acknowledged and we cannot enter into correspondence on the final result.

Please send your entries to *Dragon User*, Hobhouse Court, 19 Whitcomb Street, London WC2 7HF.

June winner

THE ANSWER to the June competition is 6 of spades, 7 of hearts, 8 of hearts and 8 of diamonds. And the winner is Robin Gadsley of Herne Bay in Kent who will be receiving a Delta disk drive system from Premier Microsystems, complete with cartridge, cable and drive.





Cuthbert Goes Walkabout
Cuthbert is on the Lunar Landing Pad, waiting for the Federal Chief's State Visit. He must turn the lights on by walking across the switches, located at the corners of the squares, before the invading Moronians get him. Watch him do his Victory Dance before he tackles the next "Pad" and another, larger, set of Moronian Invaders. Can you get your name in the Hall of Fame?
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